UNITED STATES

DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

DUCKWATER

7322

PROJECT PLAN

ORE/State office Copy

MAY 1971

STATE OF NEVADA

CURRANT RESOURCE AREA

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ACKNOWLEDGEMENT

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U. S. Forest Service

Residents of the Duckwater Area

Soil Conservation Service

Bureau of Indian Affairs

APPROVAL

APPROVAL

The following plan is prepared to meet criteria outlined in Phase II of the Bureau Watershed Planning System. It is in keeping with multiple use goals of the Bureau, the District, and the Duckwater Planning Unit and it will serve as the basis for improvement and management of watersheds in the Duckwater Project Area.

Submitted by

Currant Area Manager E. Durain Nelson Date 6/10/71

Approved by

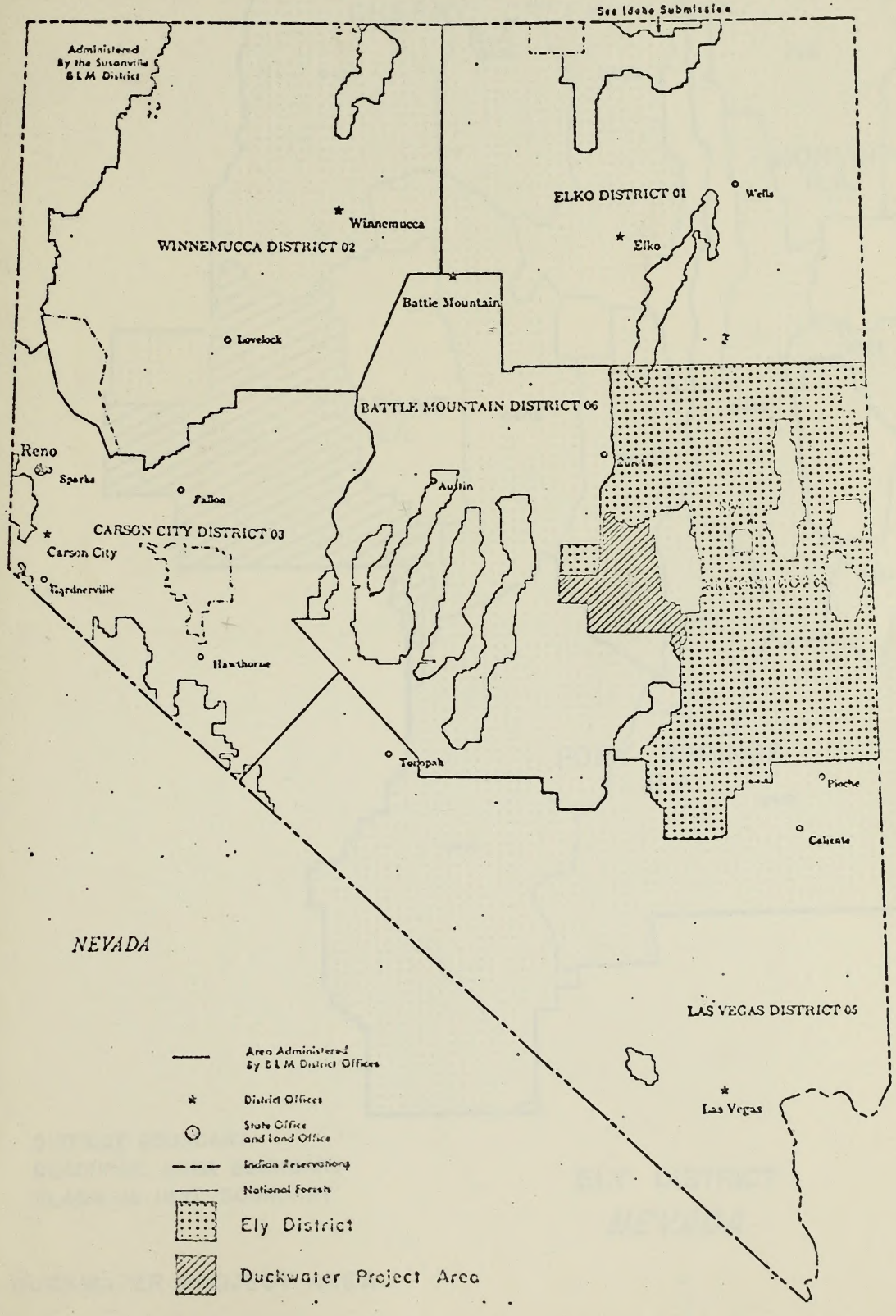
Ely District Manager Richard H. LeBaquet Date 6/10/71

Approved by

Nevada State Director _____ Date _____

LOCATION MAPS

Map Number 1


See Idaho Submission
Administered By the Susanville B.L.M. District
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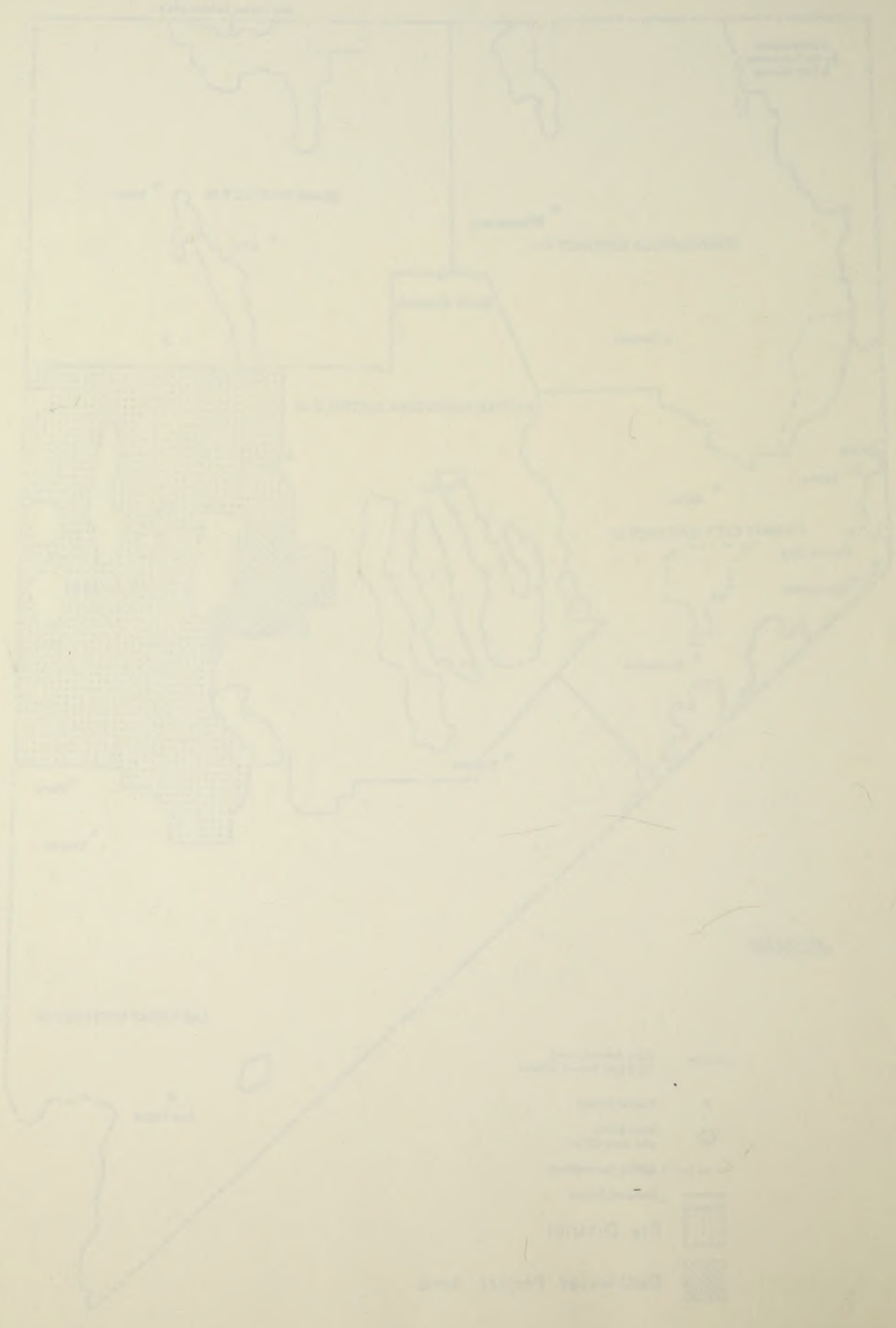
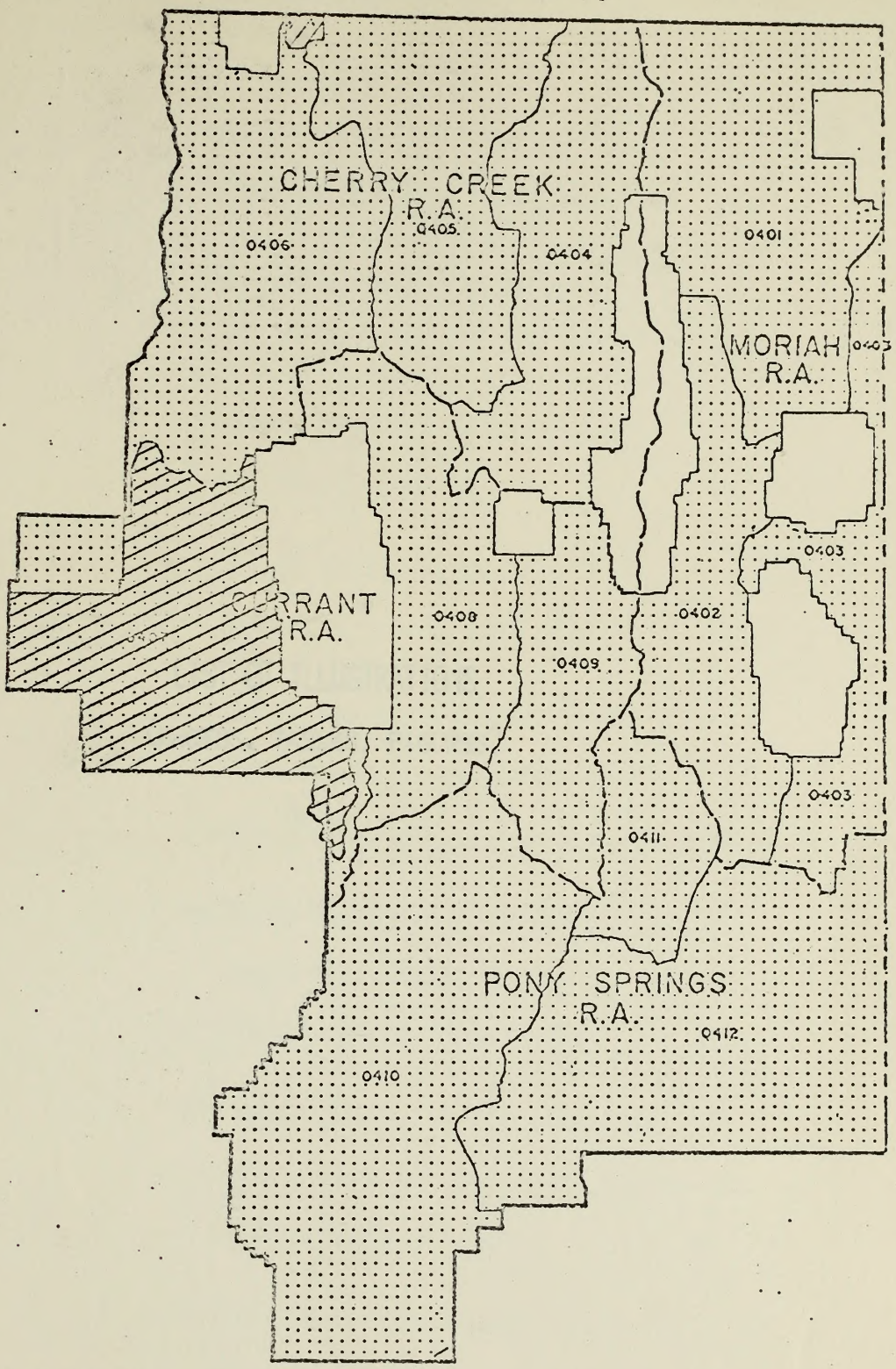


Map Number 2



LEGEND

DISTRICT BOUNDARY

RESOURCE AREA BOUNDARY

PLANNING UNIT BOUNDARY

DUCKWATER PROJECT AREA

ELY DISTRICT

NEVADA

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SUMMARY OF PLAN

The Duckwater Project includes an area 791,540 acres in size (23 square miles larger than the state of Rhode Island). It is situated in the high desert valley and mountainous country of east-central Nevada, 50 air miles southwest of Ely, Nevada.

The plan is needed for two primary reasons: (1) to reduce average annual floodwater and sediment damage to the Duckwater Indian Reservation and private lands which amount to $39,000 (Duckwater agricultural lands have been flooded 10 out of the last 12 years and the most recent flood, July 1970, damage amounted to nearly $111,000); (2) to stabilize and protect the valuable rangeland - watershed resources upon which the local residents and economy depend for a living and future generations of Americans will require for growth and security.

The plan as outlined is aimed at treating some of the basic causes of flooding and deterioration rather than the effects. Increasing plant cover and improving plant composition must be achieved in order to protect, enhance and maintain all resource values in the total environment. Five rest-rotation grazing management systems and needed facilities (fences, cattleguards, wells, reservoirs, spring developments, pipelines, water catchments) and carefully selected land treatment measures (seeding) are proposed. The estimated cost necessary to implement these facilities and measures is $3,984,130.

In addition, two floodwater detention structures are proposed to protect Indian and private lands. The cost of these structures is estimated to be $675,220. The 50 year benefits for the structures exceed the costs by a ratio of 1.11 to 1.00.

Proper maintenance of the completed project will require $154,960 annually.

Without action now, the downward trend will continue. The opportunity to restore resource values to an acceptable level and to control flood damage will become more costly and time consuming with each year of delay.

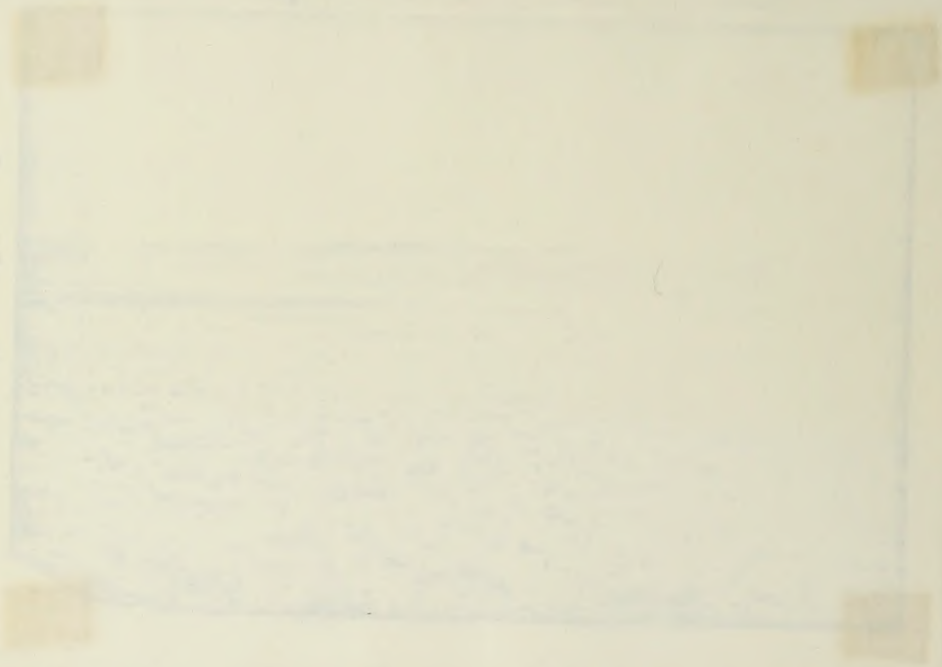
INTRODUCTION

Duckwater, a desert valley community in eastern Nevada, 50 air miles southwest of Ely, is the focal point of the Duckwater project. The community is surrounded by a vast rangeland area, (just over three quarters of a million acres) on which the Duckwater Indians and other local residents depend for a living, primarily through livestock production.

PHOTO 1

Indian Ranches on the Duckwater Indian Reservation

The watershed areas immediately surrounding the Indian reservation and other private lands in the community are fragile in nature. They have a history of feeding floodwaters loaded with silt and other debris onto the valley floor. Their fragile condition is due in part to the way nature left them and in part to the way they have been used. In the present state the situation means dollars lost, not only to local residents but also to the entire region. The estimated average floodwater damage



amounts to $39,000.00 annually. During the most recent flood, July 1970, damage reached nearly $111,000.00 8/

PHOTO 2

Silt and debris left by the 1970 flood

Requests for corrective measures have been pressed for some time; however, various circumstances have hindered progress. Among other things, information about the basic resource was lacking. The division of use areas among the various livestock operators, due to appeals and other factors, has never been settled. This has deferred positive steps toward good range management. In the meantime, soils and other resource values continue to go down hill.

In 1963 the Bureau initiated a hydrologic study to determine the extent

8/ Refer to Literature Cited in Appendix A

of the problem. Later, due to urgency of the local situation, Duckwater became a pilot area on which the Bureau's latest procedures for watershed analysis were put to work. In 1970 collection of field data for this study was completed and the stage for action was set.

Data from the watershed studies along with data concerning other resource values; (livestock forage, wildlife, minerals, etc.); were assembled to establish a base for detailed analysis. 6/

A comparison of data relating to the various use demands was then made to identify areas of conflict and to suggest possible courses of action. 5/ With this done the framework was laid to proceed with an action plan to meet the problems identified.

The primary problems identified were the prevailing deteriorating watershed condition and flood damage to agricultural lands. The most significant opportunities to correct the current situation are: (1) proper management of livestock use, (2) improvement of access roads, and (3) land treatment of highly productive areas that have deteriorated to a state where necessary vegetative cover cannot be established by management alone within the forseeable future.

The plan derived is therefore keyed to watershed problems, flood control and overall watershed conservation. The fundamental goal is to protect, enhance and maintain the quality of the environment, to protect public health and to stimulate and stabilize the local economy. As provided in

the watershed planning system, objectives and proposals outlined in the plan are defined under two headings: 1) Conservation and 2) Development.

The conservation portion deals with correction of the overall rangeland-watershed problems. It resolves livestock use demand and other basic use conflicts so flood control and watershed protection can be achieved.

The primary conservation objective is to stop further deterioration of fertile top soil by increasing quantity and quality of vegetative cover and by retaining water resources on site.

The development portion is directed to a solution of the flood threat to agricultural lands originating from the surrounding watershed. The The objective here is to treat critical areas and provide necessary structures to minimize flood damage to off-site private lands. The level of protection is aimed at the most intense storm that would occur in a ten year period based on past records. 2/

DESCRIPTION
OF
PROJECT AREA

LOCATION AND LAND STATUS

As shown on pages 4 and 5, (Maps number 1 and 2), the project area is located in the west central portion of the Ely District, which in turn is situated in east central Nevada. Currant, Nevada, a small community on the east fringe of the project area is 53 road miles southwest of Ely and 272 road miles north of Las Vegas via Warm Springs and Alamo. Duckwater is about 20 miles northwest of Currant.

PHOTO 3

Currant, Nevada - Headquarters for the Currant Ranch.

Most of the land in the area is open public land. Private lands are divided between the Duckwater Indian Reservation and other private citizens. A summary of ownership is listed as follows:

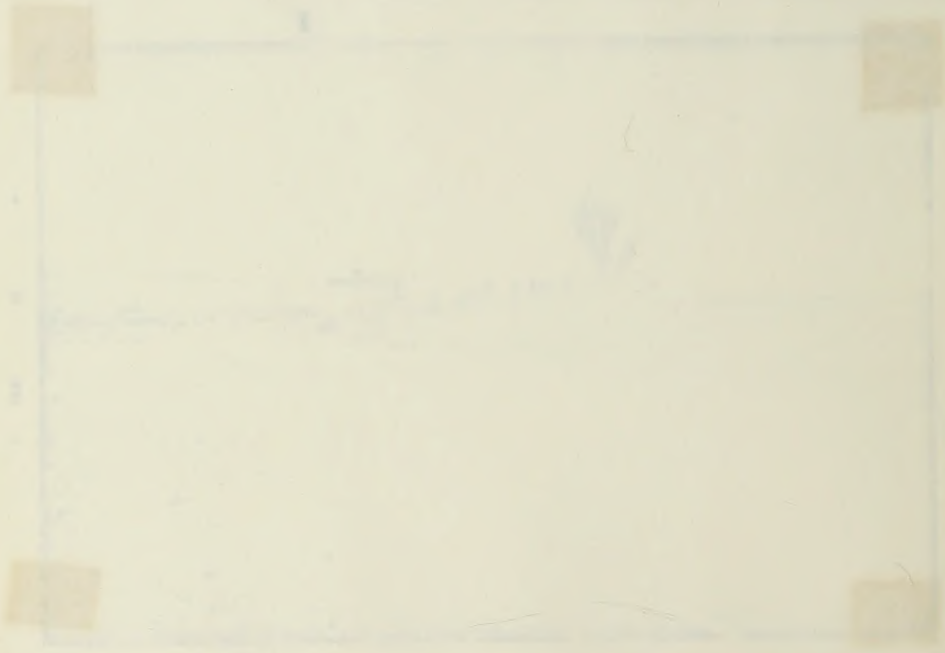


TABLE 1

LAND STATUS AND ACREAGE

Status	Acreage	Percent of Area
Public Land	777,660	98.2
Duckwater Indian Reserv.	3,200	.4
Other Private	10,680	1.4
TOTAL	791,540	100.0

PHYSICAL DATA

Physical characteristics of the project are generally typical of the Great Basin region of the west. In order to present a more specific picture of the various physical features, soils, geology, topography, water, climate, vegetation and hydrology, the following descriptions are provided.

Soils

A wide variation of soils occur over the project area due to variations in climate, relief and earth formations. A small scale general soils map (Map #9) is included in the folder on the back cover, to show the patterns of the dominant soil groups. This information was completed for the entire project area by comparing and extending soil information from surveyed portions to adjacent areas with similar vegetation and soil characteristics.

The soils are divided into ten (10) dominant soil groups each of which is made up of several families. As a whole, the soils are shallow (less than 20 inches) with coarse to medium textured loamy surfaces; they are light colored, strongly alkaline and moderately permeable; they have low available water holding capacity and are susceptible to severe erosion. A general description of each of the ten groups is included in Appendix B. 4/ 10/ 24/

For planning purposes the project area was divided into three segments: A, B, & C (see Map 3 in Map Folder).

Detailed soils information essential to good management planning is lacking on Segments B and C. This data will be acquired during the 1972 fiscal year to provide sound backing to the treatment proposals.

Geology

Mountain ranges in the area are typical basin and range fault blocks. The individual ranges expose deformed marine sediments, chiefly carbonates formed during the Paleozoic time period. Overlying these sediments are extensive lava flows and volcanic deposits laid down during the tertiary and quaternary geologic periods. 7/

PHOTO 4

Deformed marine sediments - vegetation-soil unit 3950.

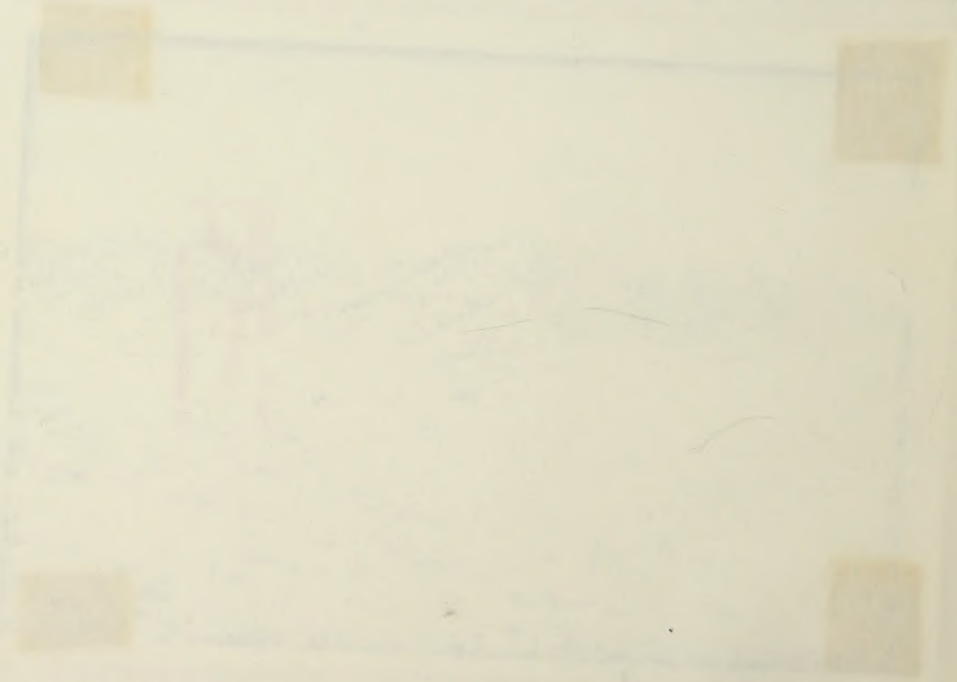


PHOTO 5

Smoothly rounded volcanic hills (ignimbrites) - vegetation-soil unit 3930.

Topography

The relief is made up of fairly broad valleys interspersed by relatively rough mountain ranges. As shown on Map #3, four major mountain ranges oriented north and south intersect the project area. They are the (1) Park Range, the (2) Pancake Range, the (3) Grant Range and the (4) White Pine Range. Four valleys result from the mountain orientation: (1) Little Smokey Valley which drains north into Newark Valley; (2) Big Sand Spring Valley drains south into the Hot Creek Valley; (3) Duckwater Valley which drains southward into Railroad Valley; and (4) Railroad Valley which extends on south out of the area.

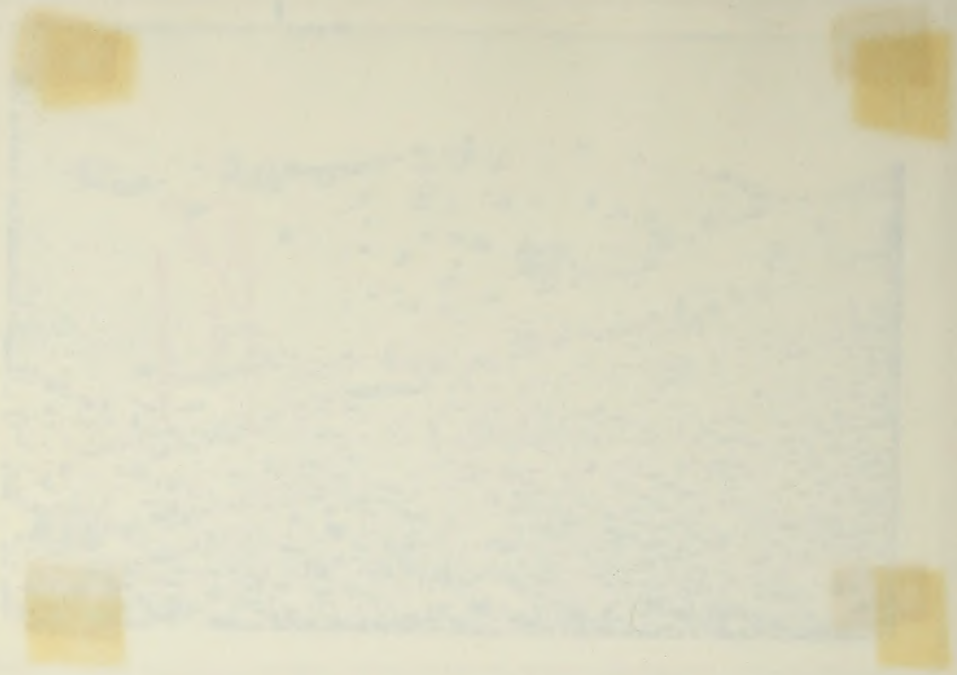


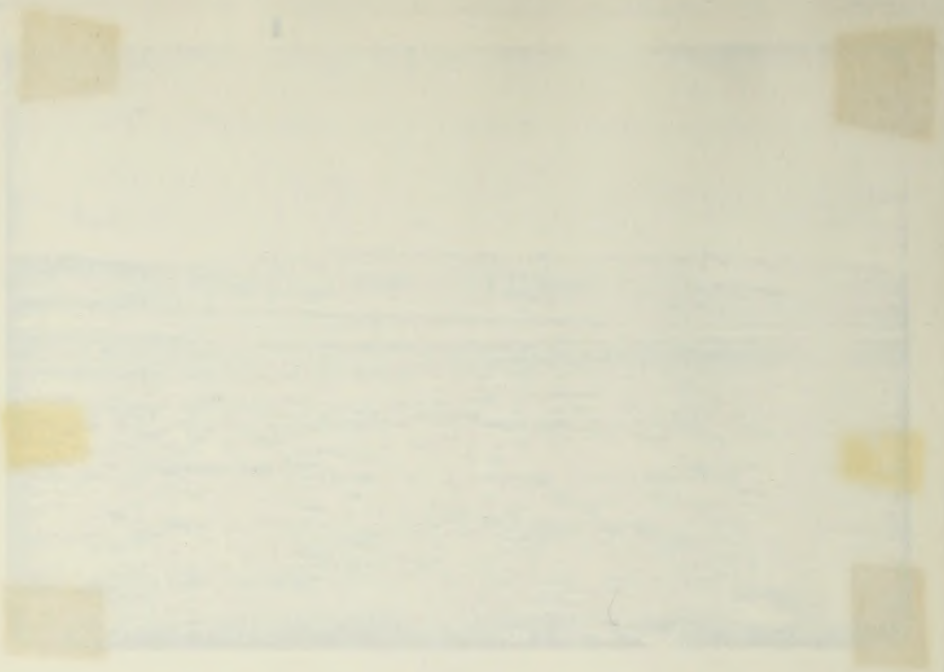
PHOTO 6

Railroad Valley looking west toward the Pancake Range (Vegetation Planning Element 141).

The lowest point in the Project Area, 4,800 feet above sea level, occurs southwest of Currant in the Railroad Valley. The highest point is Portuguese Mountain, 9,240 feet, which occurs in the southern end of the Pancake Range. Currant Mountain, 11,513 feet, is located on the Humboldt National Forest outside the project area 12 miles east of Duckwater.

Water

As shown on Map #3, the principal waters originate from four large springs: Big Warm Spring, Little Warm Spring, Bull Creek Spring, and



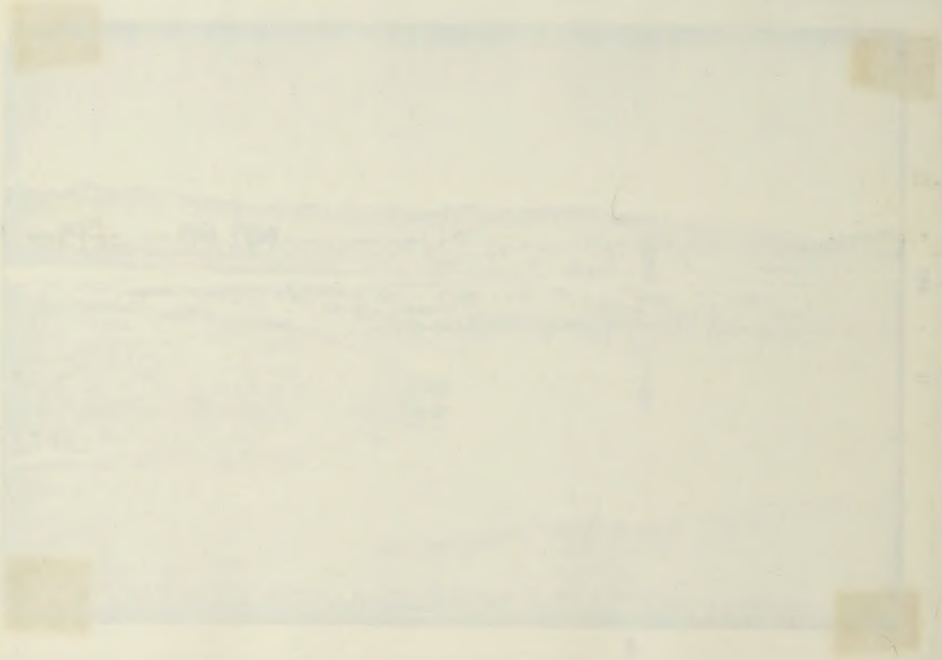
Green Spring - and one stream - Currant Creek. Little Warm and Big Warm Springs give rise to Duckwater Creek which is a primary source of irrigation and livestock water. Flow from these springs is constant and very dependable. Waters from Green Spring, Bull Creek Spring, and Currant Creek are also used extensively for irrigation and livestock watering.

PHOTO 7

Big Warm Springs is the principal water source for irrigated fields on the valley ranches.

Other sources of water include approximately 35 springs (mostly undeveloped), some wells, and a few reservoirs.

Surface or ground waters that leave the watersheds of the project area



eventually drain into the Railroad or Newark Valleys, both of which are closed basins. 21/

Climate

There are two primary sources of influence for moisture in the project area: 1. the Pacific Ocean, and 2. the Gulf of Mexico. The general storm circulation is from the west most of the year (fall, winter and spring) bringing moisture from the Pacific Ocean - approximately 37 percent of the total. The summer storms tend to be from the south, originating in the Gulf of Mexico - approximately 25 percent of the total is attributed to this source. The remaining 38 percent arises from evaporation of moisture from the Great Basin itself. The types of triggering mechanisms include convection, orographic lifting (lifting due to mountains), and two basic forms of cyclones: (1) transitory frontal systems originating in the Pacific Ocean and Gulf areas, and (2) continental cyclones developing over the Great Basin. 12/

Annual precipitation in the project area varies from approximately six to twelve inches in the valley bottoms and from twelve to eighteen inches in the mountains.

Precipitation and temperature data for the project area is summarized in Appendix C.

The lowest recorded temperature for the area, a minus 34° F., occurs in January; the highest, 99° F., occurs in July. The frost free period

ranges from 53 to 125 days depending on the location. 22/

Vegetation

Vegetation in the project area consists of three general types: (1) Northern Desert Shrub, (2) Pinyon-Juniper, and (3) Salt Desert Shrub. These broad types are further divided into nine subtypes. Information pertaining to the general types and subtypes is described as follows:

PHOTO 8

The Northern Desert Shrub Type occupies the bench and foothill areas (vegetation-soil unit 3400).

The Northern Desert Shrub Type occupies approximately 49 percent of the project area. It occurs on the upland fans and benches, the low lying foothills and on up into the lower mountainous areas. Annual precipitation

ranges from eight to fifteen inches. Most of the need to increase vegetative cover falls within this type. At present grasses and other understory species are sparse over much of the area and sagebrush (Artemisia spp.) virtually dominates. Other species natural to the type include Nevada ephedra (Ephedra nevadensis), spring hopsage (Grayia spinosa), Sandberg's blue grass (Poa secunda), wildrye (Elymus spp.), bluebunch wheatgrass (Agropyron spicatum), squirrel tail (Sitanion hystrix), needle and thread grass (Stipa spp.), Indian ricegrass (Oryzopsis hymenoides) and various forbs.

PHOTO 9

Pinyon-Juniper is spreading onto some of the lower bench areas (vegetation-soil unit 3910).

The Pinyon-Juniper Type is native to the higher mountainous areas and is spreading onto the lower bench areas. At present about 19 percent of the project area supports a growth of pinyon-juniper. The type usually occurs on shallow soiled slopes in the 12 to 18 annual precipitation zone. Single leaf pinyon pine (Pinus monophylla) and Utah juniper (Juniperus osteosperma) are the two species represented. Other associated species include sagebrush, wheatgrasses (Agropyron spp.), bluegrasses (Poa spp.) and various forbs.

PHOTO 10

Winterfat is one of the most valuable species in the Salt Desert Shrub Type.

The Salt Desert Shrub Type makes up the remaining 32 percent of the project area. This type is found largely on the bottom lands and alluvial fans where annual precipitation is less than 8 inches. Greasewood (Sarcobatus spp.), shadscale (Atriplex confertifolia), fourwing saltbush (Atriplex canescens), black sagebrush (Artemisia nova), horsebrush (Tetradymia spp.), and rabbitbrush (Chrysothammus spp.) are the principal shrubs. Winterfat (Eurotia lanata) occurs in fairly broad solid stands or intermixed with the shrub types. Great Basin wildrye (Elymus cinereus), saltgrass (Distichilis stricta), galleta grass (Hilaria jamesii), alkali sacaton (Sporobalus airoides), Indian ricegrass, squirrel tail and various forbs are also common to the type. 13/

A summary of the acreages for the various vegetative subtypes shown on Map #4 is listed in the following table:

TABLE 2

VEGETATION SUBTYPES

Subtype		Acres	Percent of Area
012	Bunchgrass	974	T
041	Big sagebrush	85,965	11
042	Low sagebrush	2,226	T
043	Black sagebrush	292,091	38
044	Rabbitbrush	12,846	2
091	Pinyon-Juniper	151,928	19
131	Shadscale	102,228	13
141	Greasewood	84,456	11
151	Winterfat	44,946	6
		777,660	

Hydrologic Studies

Due to the scarcity of hydrologic information over much of the State of Nevada, the Bureau of Land Management initiated a data collection program in 1963 titled "The Nevada Watershed Studies". Twelve key watershed areas, one of which was located in the Duckwater project area, were selected throughout the state and instrumented with rain guages and stream recorders. Soil and vegetative information for each of the sites was obtained through cooperation of the University of Nevada. 4/

PHOTO 11

Recording precipitation guages have been collecting data since 1963.

Map #3 shows the location of the study within the project area. The position of the various instruments is also shown.

Examples of the types of instruments used are shown in photos 11, 12 and 13.

PHOTO 12

Peak flow-guages show depth of water during periods of peak runoff.

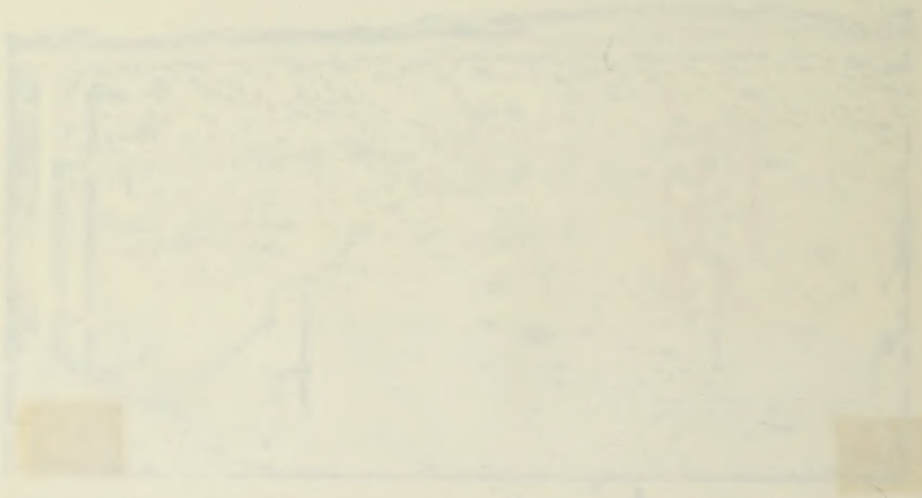


PHOTO 13

This stream recorder was almost washed out during the flood of July 1970.

ECONOMIC SITUATION

History

Nevada's economic development began in 1828, when fur trappers worked throughout the Humboldt Basin in north-central Nevada. The California Emigrant Trail was established in 1843, and the Central Pacific Railroad was constructed through Nevada in the late 1860's.

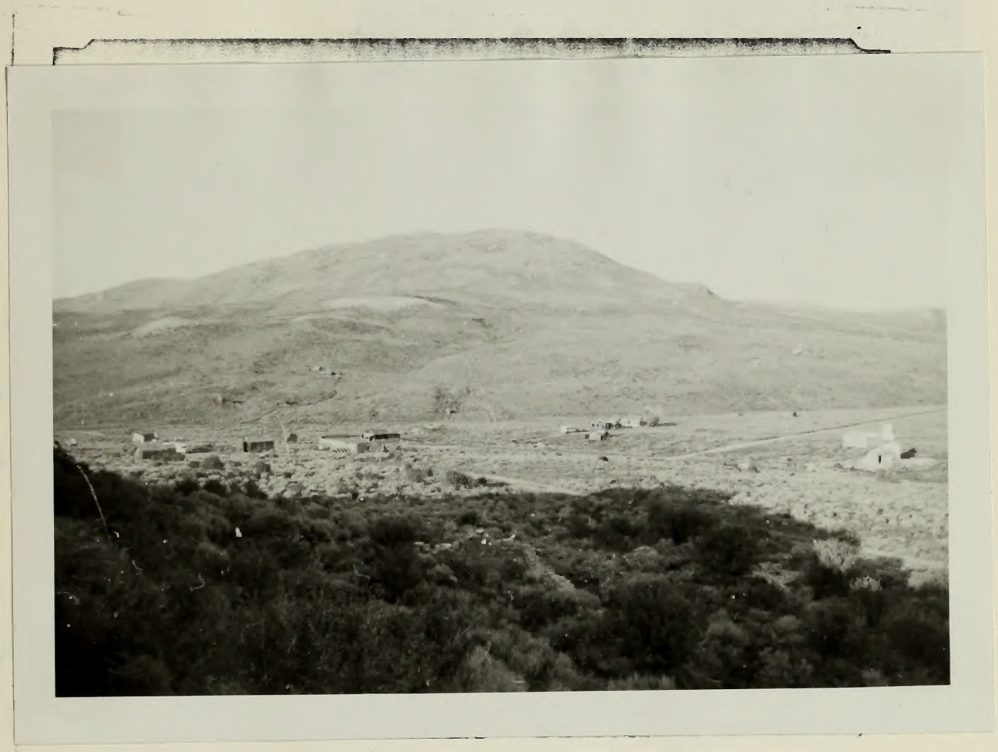


PHOTO 14

Remains of the old mining town of Hamilton, once White Pine's county seat.

Mining activity began around 1853 and quickly dominated the economy of

the state. Agriculture had its beginnings in the trek of emigrants to California and the demands of early mining camps.

In the Duckwater area, agricultural development began about 1872. Land Office records show that most of the private lands there were patented under the agricultural land laws and by state selection between 1872 and 1890.

PHOTO 15

Agricultural land on a Duckwater ranch.

Historically, the economy of the Duckwater area has always been agricultural. Local private lands have been, and are still used as base for grazing of public lands, often on a year round basis. In addition to resident operations, large numbers of sheep were trailed in for wintering from summer ranges to the north. At present sheep use, as well as cattle use, is greatly reduced.

There has been no mineral development nor other industry in the area.

Population

Preliminary 1970 census figures for Nevada show a population of 488,738, an increase of 203,360 over the 1960 figure of 285,378. The 1970 population count for Nye County, where the Duckwater area is located is 5,505 compared to 3,989 in 1960. Duckwater population is fewer than 125 people, about 2% of the county. There are now 20 families living in the Duckwater area, 15 of which (78 people or 62%) are Indians.

Personal Income

Median family income for Nye County in 1966 was $6,399 compared to the United States county median of $4,630. The Bureau of Indian Affairs estimates the per capita income for Indians living on reservations in Nevada to be about $700, or $3,500 per family. There is no evidence to indicate that Indian families living in the Duckwater area have an annual income exceeding this amount, which is about $2,899 below Nye County median income. The high income figure for Nye County appears to result from high wages paid to employees working in the northern portion, or the Atomic Energy Nevada test site.

Agriculture

The 1964 census of agriculture shows Nevada having 2,156 farms, 198 fewer than in 1959. Nye County had 121 farms in 1964, seven more than in 1959. There are presently 15 farm operations in the Duckwater area, or about 12% of the total of the county.

The value of farm products sold in Nye County in 1964 was $1,157,000. The estimated value of crops produced in the Duckwater area in 1970 was $194,948, which would be about 17% of the 1964 total of the county.

The Duckwater area contribution to the agricultural production of Nevada is primarily hay and forage. Duckwater has about 4,000 irrigated acres and about 2,500 additional crop acres. Major crops are alfalfa, meadow hay, and pasture. The estimated value of the 1970 crop for the Duckwater area is shown on Table 4 of Appendix D.

In addition to the crop production, there are thirteen cattle and six sheep operators in the area. At present, the cattle operators are harvesting an average of 12,500 AUMs on public lands in the project area and sheep operators 8,000 AUMs - total demand amounts to 50,577 AUMs.

PHOTO 16

Indian cattle being worked just before turn out on the open range.

Employment

The total work force in Nevada in December 1970 was about 242,000 of which 14,600 were unemployed - about 6.0% of the work force. Due to the agricultural influence, the unemployment is not a significant problem in the Duckwater area. The Nevada Employment Security Department does not have any claims from people in this area.

PHOTO 17

Duckwater School accommodates Indians and white students of the local area.

A table showing a comparison of land ownership and administering agency between the State of Nevada and the Duckwater Project Area is shown in Table 5 of Appendix D.

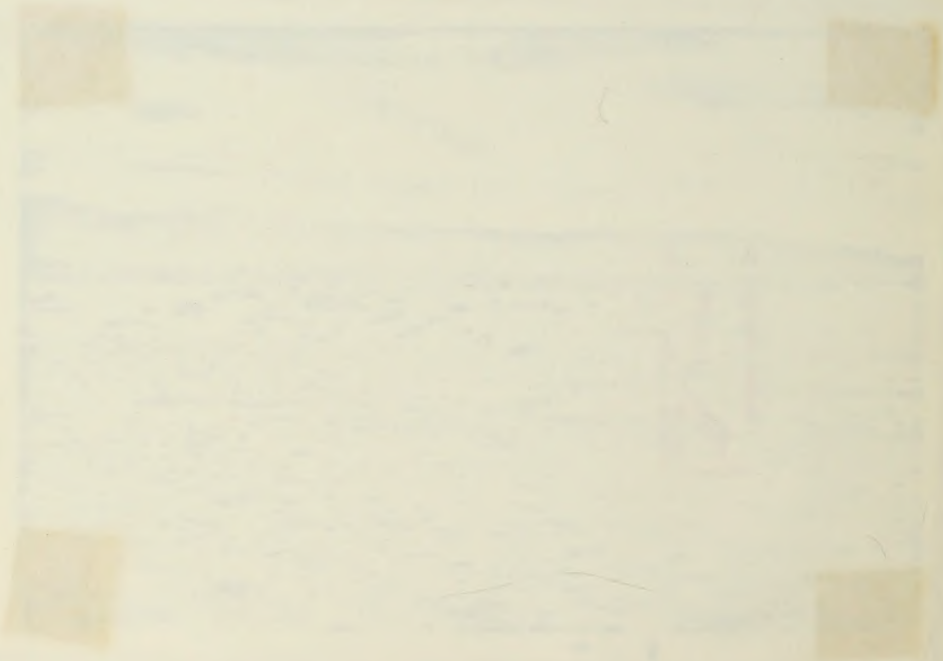
SOIL P LEMS

As discussed in a eceding ectio Page 33, the soils in the project area are highly s tible to eros . This along with several other factors accounts for the existing erosion conditions. Much of the terrain is mountainous and vegetative cover is sparse. High intensity summer storms are typical to the area.

PHOTO 18

Summer storm over the Pancake Range west of Duckwater.

The areas with the most severe problems are also the ones subject to the greatest use pressure, grazing, access, etc., due mainly to their nearness



to ranch bases in the valley bottoms.

The present soil erosion situation is illustrated on the map prepared as a part of the recent watershed study, see Map #5. Only a relatively small portion of the project area is rated in severe or critical condition as shown in Figure No. 1. For the most part, however, it happens that these are the same areas causing the greatest flood problems. This again is primarily due to their position in relation to base lands.

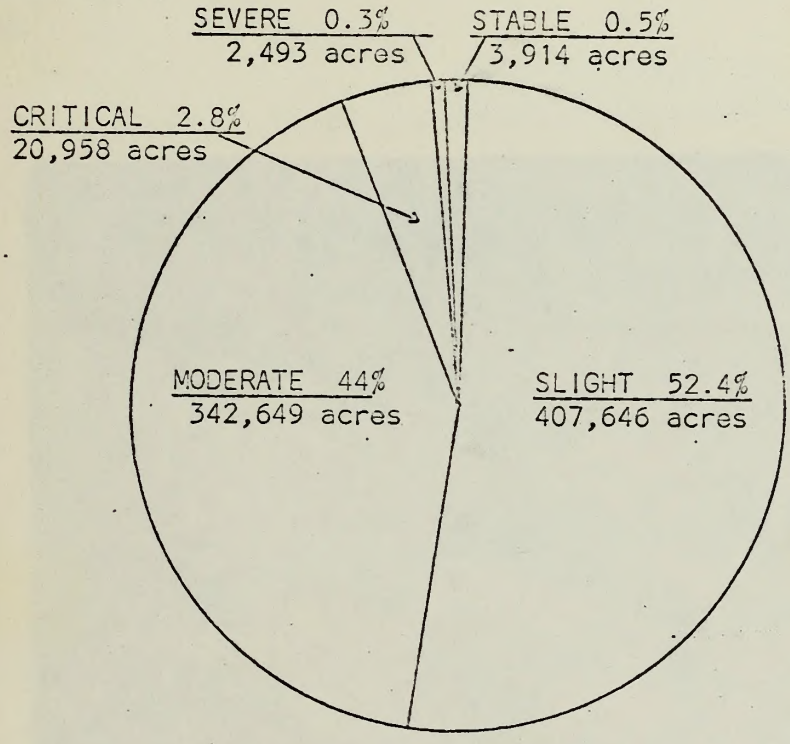


FIGURE 1

Erosion Condition Class Summary of the Project Area

The erosion condition classes depicted are a reflection of the present

erosion conditions of the soil surface determined during the first phase of the watershed studies. The rating given to a site is referred to as the soil surface factor (SSF). A numerical system ranging from 0 to 100 is used, which in turn is broken into the five headings used above: stable (0-20), slight (21-40), moderate (41-60), critical (61-80), severe (81-100).

The SSF is based on the degree of soil and litter movement, plant pedestalling, presence and size of rills and gullies, and the amount of erosion pavement.

PHOTO 19

A sand fan deposited by recent floods (vegetation-soil unit 3100).

On the 23,541 acres (most within Segment A - see Map #3) rated severe and critical, the type and extent of erosion is serious. Soil is moved with each runoff, subsoil is exposed in places and dunes of soil occur in deposit areas. Plants and rocks are pedestalled and plant roots are frequently exposed. Pavement areas are disturbed and dissected with rills of varying size. Rills 1" to 6" deep occur in exposed areas at intervals of less than 5' to 10'. Flow patterns are numerous, contain silt and sand deposits and may have significant fans of barren deposits. Gullies are found over a large part of the area and most are actively eroding.

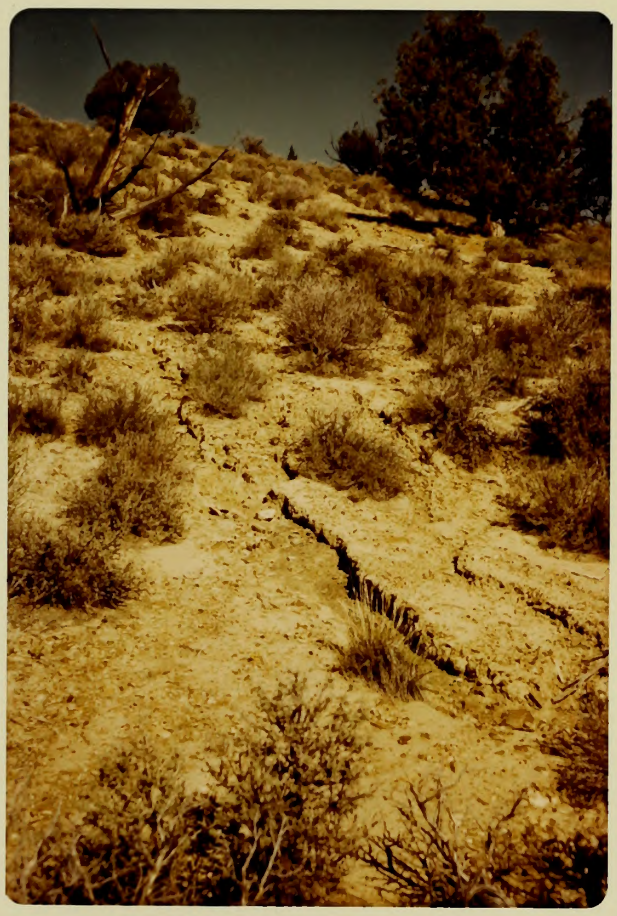


PHOTO 20

Soil loss through rills is a consequence of depleted vegetal cover.

The roads in the project area, due to insufficient drainage and sometimes poor location, particularly in Segment A, have been a source of trouble over the years. This was so again in 1970 when culverts, washes and other areas were taken out contributing to the sediment load downstream causing gullies and blocking access. In addition to the flood damage, much extra time was required detouring to obtain access into portions of the project area.

PHOTO 21

Washes across roads block access and contribute to increased sediment loads.

Erosion, on the areas rated moderate is significant and covers a much larger area, but is much less severe than on areas judged critical as described above.

In order to devise a basis of recommending treatments and proposals to

arrive at a solution to existing conditions, the soils and vegetation of the project area were divided into specific units, called vegetation-soil units and vegetation planning elements. These units are shown on Map #6 and were prepared during the second phase of the watershed studies of the Bureau. Data from studies conducted by the University of Nevada and other research data was used to supplement that of the Bureau in making the breakdown. The opportunity to improve each site depends on the current SSF rating along with such things as slope, vegetative cover, soil type, effective root depth, rainfall intensity, etc.

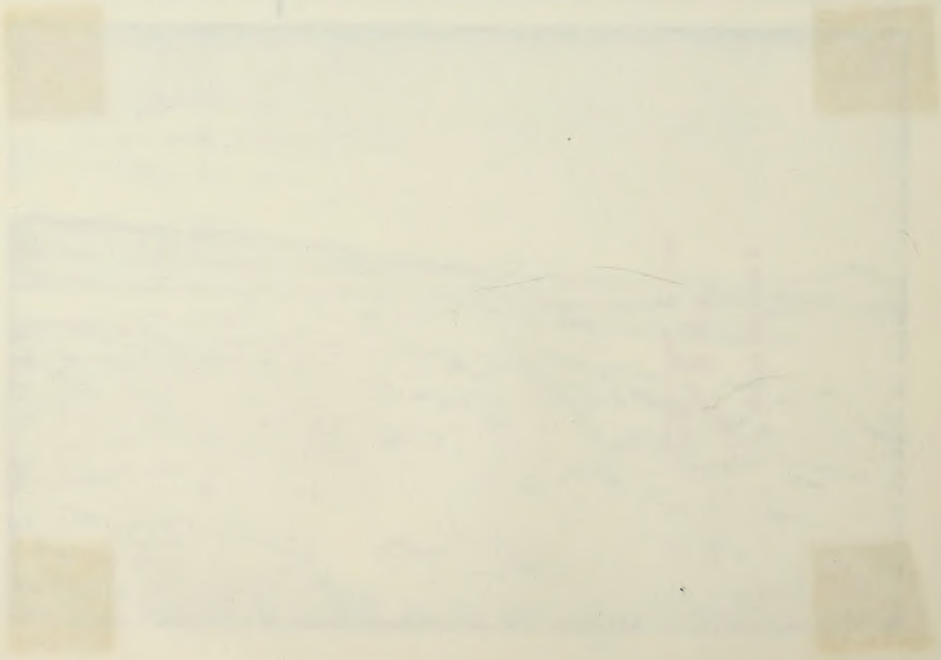
WATER PROBLEMS

The two live streams in the project area, Duckwater and Currant, have both received channel damage from periodic flood runoff. Irrigation structures used in connection with these streams have also been damaged extensively. 8/

Sediments carried during peak runoff periods have been detrimental to fish and other acquatic species. During the 1970 storms Big Warm and Little Warm Springs, the water source for Duckwater Creek, were inundated. This caused the loss of many Railroad Valley Spring fish (Crenichthys nevadae). These fish are native only to these springs and are among the rare and endangered American species. 19/

PHOTO 22

Deposits of sediment and debris following passage of flood water July 1970.



Due to low precipitation, high evaporation and shallow soils, little or no potential exists for increasing water yields. Only two percent of the area receives more than 17 inches of precipitation and these areas occur on the mountain tops in extremely rocky soils.

The most beneficial use of available moisture can be obtained by retaining as much as possible on site to improve and maintain vegetative cover and soil fertility.

FLOOD AND SEDIMENT DAMAGE

Flooding of Indian and other private lands has occurred during July and August ten out of the last twelve years (1959-1970). The largest and most recent flood happened July 22, 1970. The total damage for this flood was $110,651.00. This amounted to $29.47 per acre. The estimated annual loss per year for the remaining eleven years is $39,312.00. 8/

PHOTO 23

Flood waters on private lands.

The Indians and other residents, in cooperation with the Bureau of Indian Affairs and Soil Conservation service, have constructed a floodway channel across the private lands. In 1970 this channel was heavily damaged. The Bureau of Land Management is obligated to take action on the surroun-

ding watershed to keep this and other structures from being ruined.

The storms that contribute uncontrolled floodwater runoff from the watershed areas may be grouped into two classes. Those that have a probability of occurring more often than once in a ten year period and those that would occur less often than once in a ten year period.

Damage from smaller floods, having a probability of occurring more than once in a ten year period, is usually limited to crop damage. The extent of loss depends on the stage of crop growth.

PHOTO 24

Extensive damage has been done to fences and other physical facilities.

The larger more infrequent floods having a probability of occurring less often than once in ten years cause more extensive harm. The effect to

crops is more severe besides additional damage done to physical improvements: ditches, roads, buildings, fences, etc. The most recent flood fell in this category. According to the study conducted by the University of Nevada previously mentioned, the loss to crops and physical facilities was $11.95 and $17.52 per acre respectively. 8/

HUMAN WELFARE

No loss of life due to flooding has occurred. The possibility of such an event at Duckwater is considered remote, although under certain circumstances it could happen.

The influence to human welfare is nevertheless very real. In years like 1970 the local residents are forced to replace hay and other supplies with purchased goods. Funds must come from emergency allocations from the government, bank loans or their own personal reserves.

PHOTO 25

Hay and other produce lost during flooding must be replaced.

Correction of the flood threat would relieve hardship to local residents and would provide a stimulus to the entire regional economy.

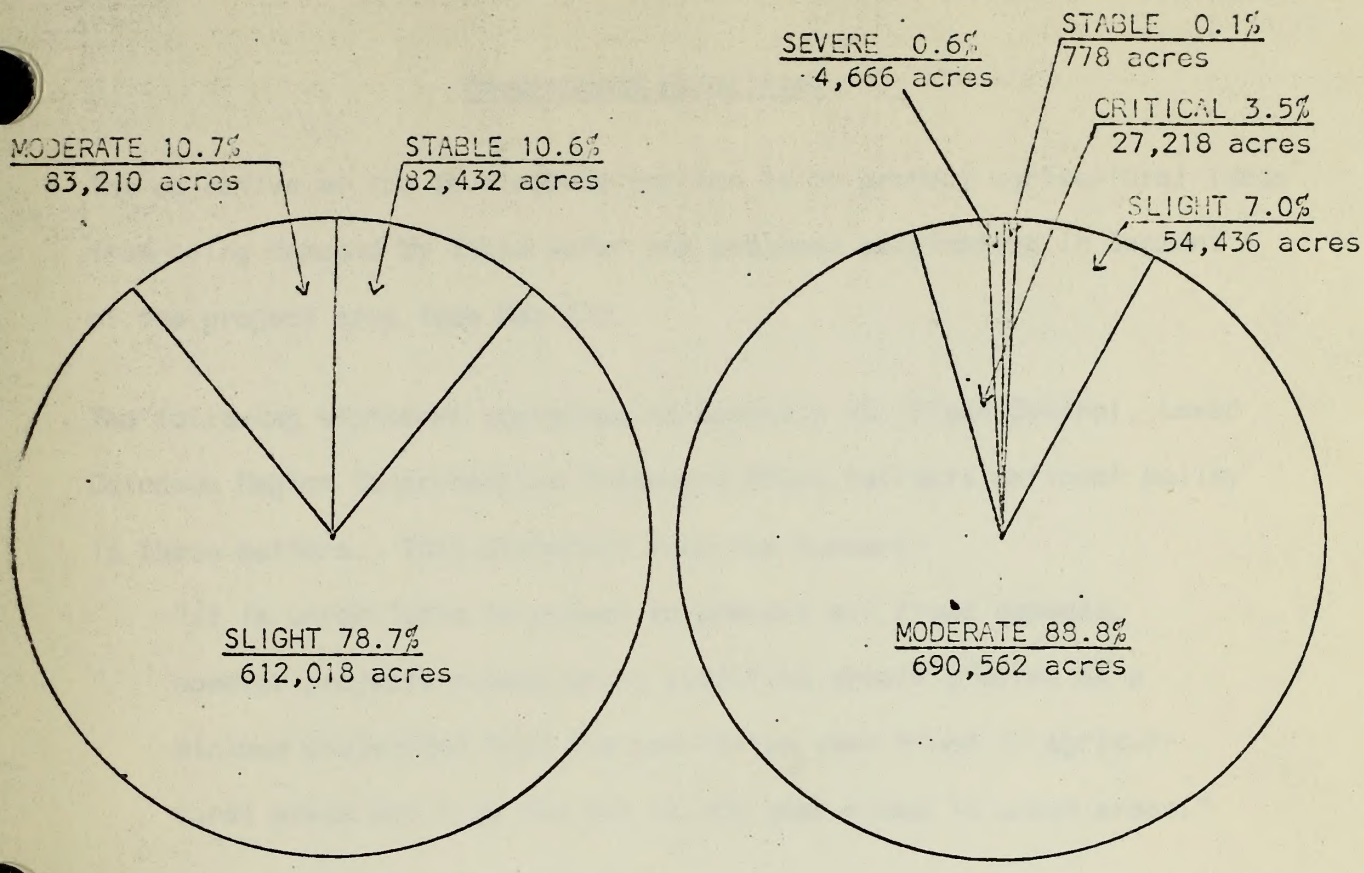
OBJECTIVES OF THE PLAN

The overall objective of the plan is to protect and enhance the quality of the environment of the public lands in the project area and to protect the public welfare on associated off-site private lands. Specifically the proposals are aimed at two levels of activity:

1. The first termed the Conservation Portion is aimed at stopping further deterioration of the resources over the broad scope of the project area.
2. The second termed the Development Portion goes beyond the conservation level in critical areas to prevent off-site damage to private lands and to the public welfare

Conservation Objectives

The specific goal to be achieved through the conservation portion is to reduce the soil surface factor (SSF) from its present value to the lowest possible rating that can be expected for the site under proper management practices. Allowing a ten year period to realize the change, the following graph (Figure 2) shows the improvement that should be realized for the project as a whole. Also shown is an estimate of what the situation will look like in fifteen years without treatment.



Future with Project

10 years hence

Future without Project

15 years hence

FIGURE 2

Conservation objectives for changing erosion condition class on project as a whole compared to predicted condition without the project.

The objective for changing the SSF is further broken down for each vegetation-soil unit in Appendix E.

Development Objectives

The objective of the development portion is to protect agricultural lands from being damaged by flood water and sediment originating in Segment A of the project area (see Map #3).

The following statement contained in Appendix IX, Flood Control, Lower Colorado Region Comprehensive Framework Study reflects national policy in these matters. This statement from the summary:

> "It is unrealistic to expect to prevent all flood damages, however projects economically justified should provide as a minimum protection from the one-in-ten year flood in agricultural areas and from the one in 100 year flood in urban areas."

This sets our policy in providing flood protection to the lands in question. 2/

Flood waters detained by the proposed developments will be released at a non-damaging rate into the 1000 cubic foot per second floodway through Indian lands. The developments proposed to reduce flood and sediment damages from the principal source area are aimed at this goal.

ACTION PLAN

Implementation of the two portions of the plan, conservation and development, are interdependent and must be accomplished in coordinated sequence with each other. Although the primary emphasis is devoted to improvement of the watershed and flood control, there is a close tie with all other resource values: range, wildlife, recreation, etc. Much of the logic behind the following proposals is prompted by the needs of the various use demands for these resource values. Some of the effects along with special allowances for these use demands as they relate to the proposals are outlined in brief under IMPACT ON OTHER RESOURCES, beginning with Page 82.

An outline of the conservation and development proposals thus derived is provided as follows.

Conservation Proposals

Several alternatives were evaluated in arriving at a method of achieving the conservation objectives. Each approach, although oriented toward grazing management, differed considerably in kind and degree of management used. Among the proposals considered were:

1. Low intensity management - with no land treatment: Divides the project area into allotments - sets seasons of use and provides minimum water facilities.
2. High intensity management - Rest - Rotation with no land treatment: Establishes five allotments - provides water, pastures and other physical facilities for Rest-rotation systems.

PHOTO 26

The vegetal cover on this site is reduced - a remnant of grass remains in the understory. (vegetation-soil unit 3200 SSF 38)

PHOTO 27

Under rest-rotation management sites similar to that shown in Photo 26 can look like this. (vegetation-soil unit 3200 SSF 251).

3. High intensity management - Rest-rotation with land treatment:

Divides project area into five allotments - provides physical facilities for Rest-rotation management and provides for land treatment of high potential sites where accelerated deterioration of the soil resource is occurring as a consequence of the depleted vegetal cover.* These sites, due to the scarcity of a seed source, will be treated to remove competition from sagebrush and pinyon-juniper and will be seeded to an adapted seed mixture.

The last alternative was chosen due to the overall advantages it offered in reaching the objectives; some of which are listed as follows:

a. It is the only method which fully meets the objectives. Due to the virtual absence of a native grass seed source in many of the sites in question, the only feasible way to get the needed ground cover is through carefully selected land treatment methods.

b. The effectiveness to cost ratio is better under alternative 3 than alternatives 1 and 2.

c. It has a greater stabilizing effect on the economy and compliments other resource values most.

d. It provides the best opportunity to compensate the loss of forage due to past grazing reductions and pending restrictions in areas of use.

*See Map #7: Existing and Planned Works of Improvement.

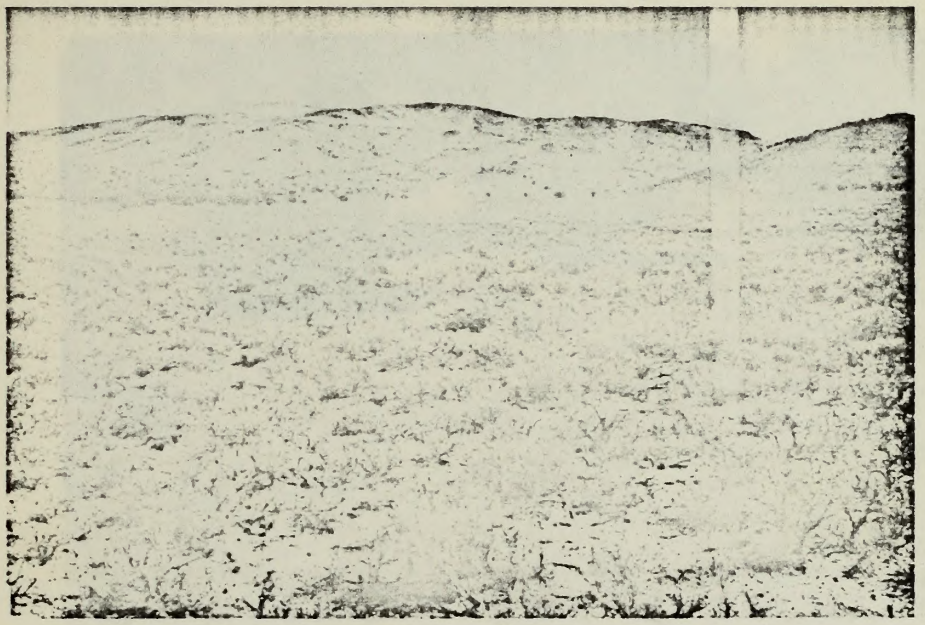


PHOTO 28

Due to the absence of understory species, sites like this will require land treatment to restore adequate vegetal cover in order to stabilize the soils - SSF 20. (vegetation-soil unit 3470 present SSF 49)

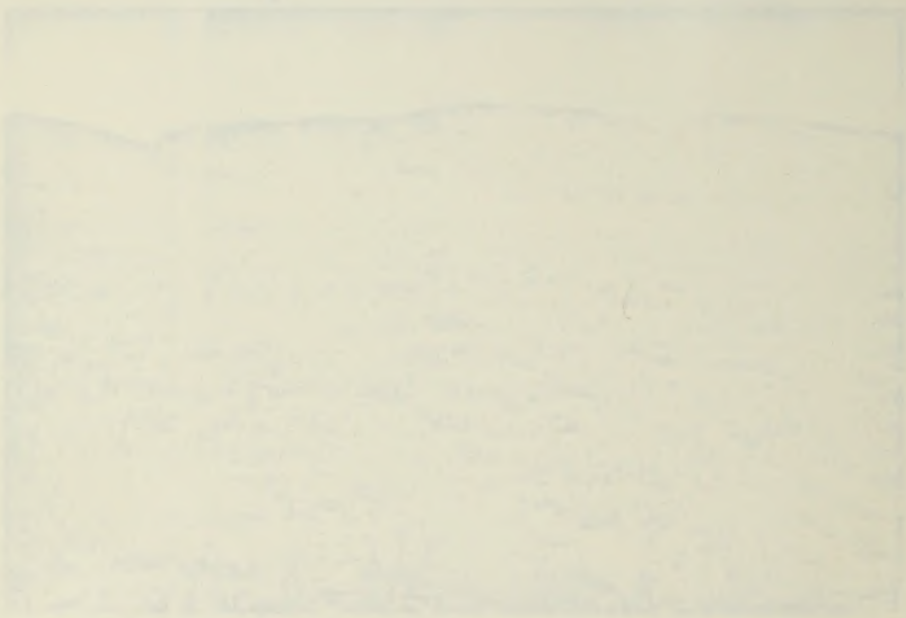


PHOTO 29

A depleted vegetal cover such as this is common when Pinyon-juniper invades productive benchland sites. In order to protect the soil and restore productivity sites like this will be chained and seeded. (vegetation-soil unit 3920 present SSF 68)

Results of studies on chainings clearly show some of the benefits to watershed conditions. Data to illustrate this (shown in Figure 3) is taken from a typical chaining in the Ely District.

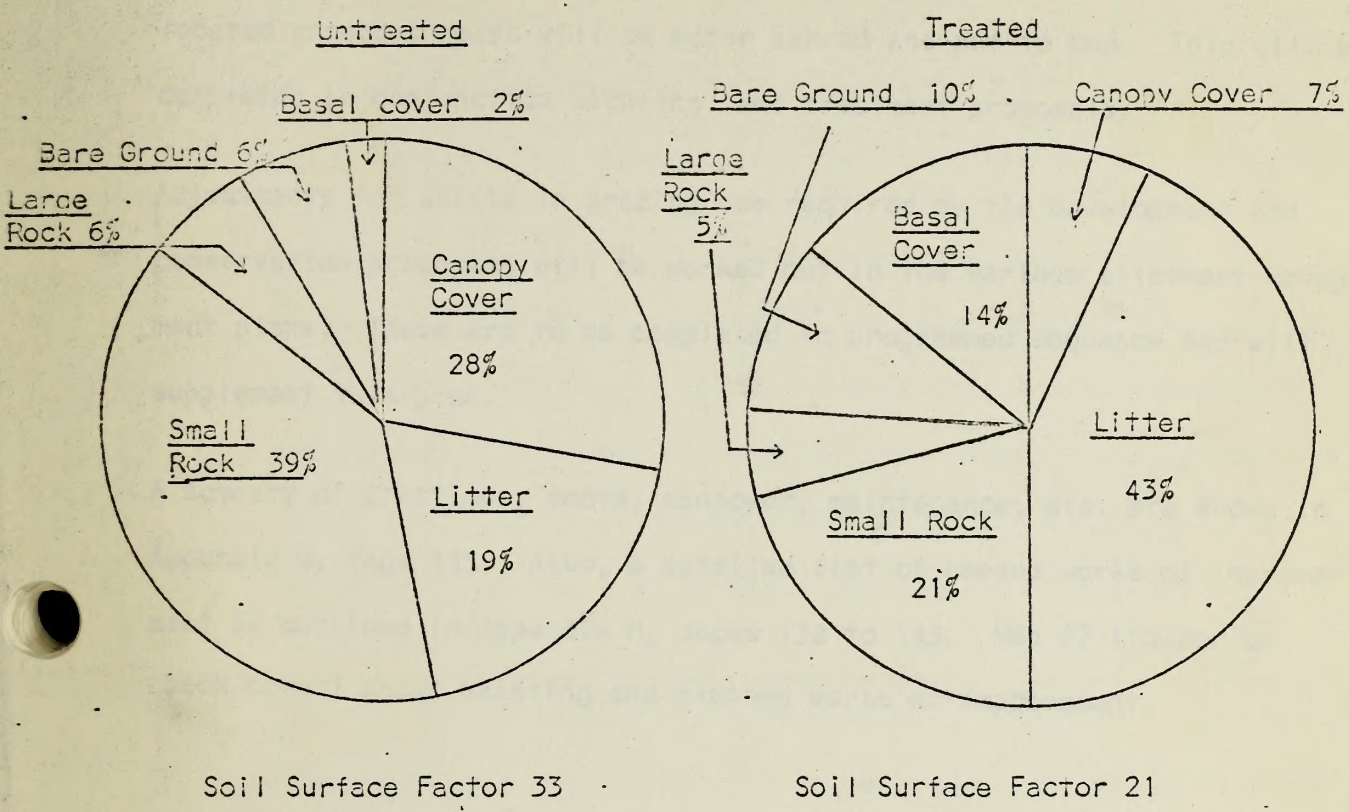


FIGURE 3

Comparison of soil cover between untreated and treated areas - following chaining and seeding.

The data shown was collected 3 years after treatment. The site was chained and seeded with adapted species. The most significant change is the marked increase in basal vegetal cover and litter and the decrease of the SSF to a stable value.

Upgrading of roads will be a part of the conservation program. This will be accomplished largely through the road maintenance program. It will be necessary to provide access to some isolated areas. This can be done by means of carefully laid out and constructed truck trails. Poorly located unneeded roads will be water barred and put to bed. This will be completed in conjunction with the land treatment proposals.

Adjustments for shifts in grazing use required by the development and conservation proposals will be worked out in the various allotment management plans. These are to be completed in programmed sequence and will supplement this plan.

A summary of practices, costs, manpower, maintenance, etc. are shown in Appendix G, Page 135. Also, a detailed list of needed works of improvement is outlined in Appendix H, pages 138 to 145. Map #7 (folder on back cover) shows existing and planned works of improvement.

Development Proposals

The development proposals are confined to critical areas of the watershed in Segment A. The proposed actions are designed to curb the rate of flood runoff to protect offsite damage to private lands. Structures and treatments planned to get the job done, after weighing the various alternatives, are listed as follows and are shown on Map #7.

1. One large detention dam - location shown as No. A, Map #7. Specifications for the structure are shown on Appendix H, Table 24. This structure will control runoff from critical portions of Segment A. Protection from rainfall runoff is the primary aim. Runoff danger from smow melt is not considered critical since it is spread over a longer period, i.e., 3-5 days with much lower peak flow rates. The outlet structure will pass .1 inch of runoff from the watershed area per 24 hours. The reservoir area will be capable of detaining .28 inches of runoff in live storage in addition to the above continuous flow capacity.

2. Beginning at a point approximately three miles downstream from the detention dam, Site No. B, Map #7, the existing flood plain will be used to construct a water spreading system (see Appendix H, Table 24). The system will consist of earth dikes with adequate pipe weeps, diversions and a drop structure just above the Indian Reservation where flood waters will be released into the spillway channel.

Floods with greater than the one in ten year recurrence interval will be detained within the waterspreading area. Waters will be held in the storage areas between the dikes; earth spillways will accomodate flow between dikes. These floods will then be channeled over an emergency spillway at the terminal structure. The flow is not anticipated to exceed 1,000 cubic feet per second, which is within the capacity of the Indian spillway. To gain full benefit of waterspreading the area (650 acres) will be planted to suitable grasses. It will then be fenced and managed in conjunction with the allotment management plans.

3. In addition to the proposed structures, grazing will be deferred on most of Segment A during the spring and summer periods. This will be done to retain as much cover as possible during the danger period for high intensity summer storms.

A total of nine sites were investigated that had possibilities of containing structures which would economically reduce flood damage from waters originating in the source area. Detention could be achieved either singly or in various combinations. Each site was evaluated and an estimate of the size of structure required to provide storage for anticipated volumes of water and silt was computed. These are tabulated on Table 24 of Appendix H.

The development portion of the plan can be initiated at any stage in harmony with the conservation portion of the plan. Prior to programming,

a topographic survey of the areas designated to contain detention structures needs to be completed. This is tentatively scheduled for FY 1972. Additional foundation investigations and final design can then be finished as required and construction programmed for completion.

An itemized list of practices and costs for the development program is included in Appendix G, page 135. A list of specific jobs is included under job details, Appendix H.

The size and number of development structures is based on estimates of runoff from the hydro study. Allowance is also made for expected improvement in vegetative cover as a result of the conservation program. Without this part of the plan, the size and number of detention and spreading structures would increase significantly.

ECONOMIC ANALYSIS OF PLAN

ECONOMIC ANALYSIS

Conservation Proposals

Details of the economic analysis for the Conservation Phase of the program are included in Appendix F. Effectiveness to cost analysis (E/C) is used when it is not possible to place a dollar value on the output or performance. It finds the alternative solution to a problem which yields the greatest effectiveness or efficiency for any given cost. The annual amount of effectiveness and costs are discounted so that the ratio reflects efficiency in terms of the present value of future effectiveness and costs.

The three conservation alternatives were subjected to effectiveness to cost analysis with the following results:

Alternative	E/C Ratio
1. Low intensity management - no land treatment	0.17 : 1
2. High intensity management - no land treatment	0.22 : 1
3. High intensity management - with land treatment	0.26 : 1

Since alternative number three has the highest effectiveness to cost ratio, for each dollar spent there are more benefits accrued than under alternatives one and two.

Development Proposals

Details of the economic analysis for the Development phase of the program are included in Appendix F. The most appreciable benefits are annual flood damages avoided and additional livestock forage gained as a result of the treatments. Benefit to other factors such as recreation, aesthetics, and general resource value will also be realized. The benefit, however, from these was not considered measurable at present and was therefore omitted from the analysis. Total benefits estimated over a 50 year period amount to $729,554.00. Total costs equal $659,985.00 for the same period, thus giving a 1.11 to 1 benefit to cost ratio.

IMPACT ON OTHER RESOURCES

IMPACT ON OTHER RESOURCES

The purpose of this section is to show the interrelations of other resource values and uses (range, wildlife, recreation, forestry, lands, and minerals) to the action proposals. Policy guides to allow protection of special resource values are also outlined, as they apply to each of the items listed above, and become an integral part of the action plan.

RANGE

During the analysis of background material, past and present grazing practices were identified as having the greatest impact on condition of the watershed. This of course related specifically to items over which control can be exercised. Common use among the various operators has been the general practice throughout the project area over the years. Although some degree of division in use has taken place in the form of customary use through gentlemen's agreement, there has been considerable overlap. Conflicts in use area have been common, particularly between cattle and sheep users.

In 1963, the available forage was determined by range survey and a subsequent 40% reduction was imposed to bring the demand into balance with present resource production. Attempts were then made to allot the project area, but never finalized due to appeals and other reasons.

Now due to declining conditions, aggravated by movement of flood waters over the watershed areas, another restraint is recommended which will add to the hardship of range use. Livestock grazing on most of Segment A must be deferred until fall. Up to the present time, this has been spring, summer, and fall range for the Indians and spring and late fall for the sheepmen and other users.

There is potential in Segments B and C to absorb such a shift. However, there is insufficient water, no fences, and, on many sites, a lack of forage. What takes place overall is a "chain reaction" effect - stresses imposed in one area alter use in other areas. A fence to separate one allotment blocks access to customary waters and forage in another. To be effective in achieving the conservation goals, sufficient improvements need to be developed to compensate for the various losses and restrictions and to establish a base for good management.

Without action, the downtrend of resource values will continue. Further reductions may be considered as a solution, but it is well proven that such an approach does not reach desired results. The best tool to compliment all resource values and to establish a framework for the conservation and flood control is sound grazing management.

The most desirable method for doing this will be implementation of the five rest-rotation grazing systems.

The most significant beneficial impact of the project on range use will be restoration of the 40 percent reduction.

WILDLI

Due to lack of wildlife studies with the project area, little concentrated information has been gained w respect to wildlife species and use patterns. Primary game species known to exist in the area include sagegrouse, Hungarian partridge, mourning doves, mule deer, antelope, and bighorn sheep.* Very little is known of the latter species and no hunting of either antelope or bighorn sheep is reported. Coyote and mountain lions are the principal predators. Birds of prey include Golden Eagles and hawks. A wide variety of other species occur over the area; a sample of which include desert foxes, weasels, rabbits, other small mammals, lizards, snakes, ravens, jays, and numerous small birds.

Other animals of current attraction are wild horses which range over the more remote and mountainous areas of the project.

Also of significant interest are the Railroad Valley spring fish (Crenichthy nevadae). 9/ These fish are native to Warm Springs peculiar to this and similar desert valleys and are among the rare and endangered American wildlife species. Many of these fish have been destroyed as a result of flood damage.

There is significant opportunity to increase all wildlife populations. This is particularly true of antelope, sage grouse, and possibly bighorn sheep. With increase in game numbers, hunter days will also increase. The present estimate of hunter days per year is 150; with the proposed program it is estimated this will increase to 750.

*See Map #8 for a general picture of wildlife distribution.

Policy guides to protect and enhance wildlife values are listed as follows:

Policy Guides

1. Construct guzzlers in conjunction with pipelines and other water facilities to provide water for wildlife.

2. Install bird ramps and other necessary devices in all open storage tanks to insure protection of wildlife.

3. Design fences to accommodate antelope and deer crossing - use wire spacing 18" 8" 8" 8" as recommended by the Nevada Fish and Game Department.

4. Design land treatment projects to gain advantage of the "edge effect" and to preserve adequate vegetative cover - leave islands or strips of native brush as necessary and use irregular boundaries fitting to the terrain.

5. Restore native grasses and forbs through management where ever possible. In areas that require seeding use mixes of grasses, forbs, and browse - adapt mix to the site treated.

6. Identify all potential meadow areas and concentrate management to improve these sites.

7. Identify all sage grouse strutting grounds prior to land treatment to insure protection of these areas.

8. Cooperate with the Nevada Fish and Game Department to complete any other needed species surveys and to coordinate all aspects of habitat treatment with species management programs.

RECREATION

The solitude and vastness of the project area is probably its greatest recreational quality.* The heart of the area lies 360 air miles north east of Los Angeles and 200 miles north of Las Vegas. Except in winter or periods of inclement weather, a visitor can explore portions of the wide valleys and skirt the flanks of the mountain ranges with an ordinary vehicle.

Indian relics, arrowheads, beads, pottery, and other artifacts may be found around springs and other camp areas formerly used by ancestors of the Indian people.

Recent history is tied closely to the rise and fall of mining camps on the perimeter of the project area. Hamilton, situated to the north east at the base of Mt. Hamilton, is now one of Nevada's ghost towns. It was once a bustling mining town and county seat of White Pine County. The town of Morey, located to the south west began as a silver camp in 1865, peaked around 1874, and then faded into history by 1891. During its peak, a daily stage departed for Eureka, 60 miles north via Pritchards, Burnt, and Pogue stations, the latter two within the project area.

"Pritchard's Fast Freight" reportedly made the trip from Pioche, Nevada, to Palisade, Nevada, a distance of some 230 miles in 72 hours using twenty-mule teams. Currant, Governor's Springs, Pogues and Fish Creek made up a part of the Way-Station network. Some of these old ruins still

*See Map #8 for sites of location of sites of interest.

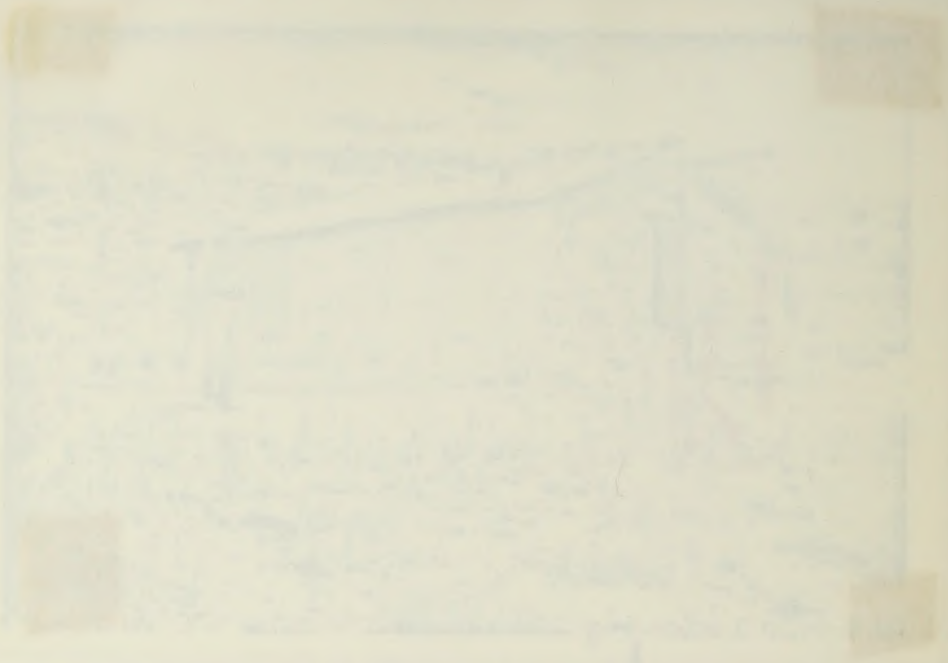
remain and should be preserved.

PHOTO 30

Ruins at Governor's Spring: probably a part of the way-station net work for "Pritchard's Fast Freight".

A scenic mountainous area known as the Park Range lies along the extreme south west portion of the project area. Due to its isolated nature, the area has remained largely untouched. Today with ever increasing demand for open space, areas like this offer a unique opportunity to preserve the qualities of the natural habitat in a primitive unmolested state.

The impact of the project in terms of increased visitor days is difficult to appraise due to lack of local back up data. Based on the number of



areas of interest, visitor days will likely increase from about 75 to near 500 per year as a result of project development.

Policy guides to protect and enhance recreational values are listed as follows:

Policy Guides

1. Use general landscape techniques to blend land treatment jobs with the natural terrain.

2. Use curved line design - avoid long straight lines in construction of pipelines.

3. Avoid extensive clearing of fence lines (bladed lines) - use silver gray posts to blend with vegetative cover.

4. Preserve primitive qualities of the park range.

5. Cooperate with the Nevada State Curator of Anthropology in completing studies of springs and all other possible archeological sites in advance of project work.

6. Provide historical markers and signs to identify sites of significant historical or archeological value.

7. Sign main access roads to keep tourists from being side tracked into remote off track areas and to identify areas of interest.

FORESTRY

The timbered sections of the project are limited for the most part to the mountainous areas, and are considered woodland rather than forested areas. Pinyon pine and Utah juniper are the principal species. This type offers some opportunity for production of pine nuts and posts, but is chiefly valuable for its scenic qualities.

The conservation plan requires land treatment (chaining and seeding) of some of the Pinyon-Juniper type. However, treatment is limited mostly to key bench areas and will only involve a small portion of the total area, approximately 10 percent.

Policy guides to preserve and protect wood land values are covered under wildlife and recreation policy guides for land treatment.

MINERALS

The only mineral activity of any significance in the project area has been limited to oil and gas surveys. One oil well was drilled with no success in the northern part of the area in the Pancake Range. Several oil wells are currently in operation just below the project area - 12 miles south of Currant.

Very little attention has been devoted to other types of mineral prospecting, due to lack of prospective mineral formations. No mineral activity of any consequence is anticipated in the area.

LANDS

Land status in the project area is stable. Future disposal programs of any significance are not expected. Low lands in the area are too saline and higher areas are generally too rough to be suited to agricultural development. Ground waters are also limited, especially in the higher valleys like Little Smokey Valley. Little activity has transpired with public sales; only one sale (40 acres) has been processed in the last ten years. The lands have been classified for multiple use management and are expected to remain in this status for the forseeable future.

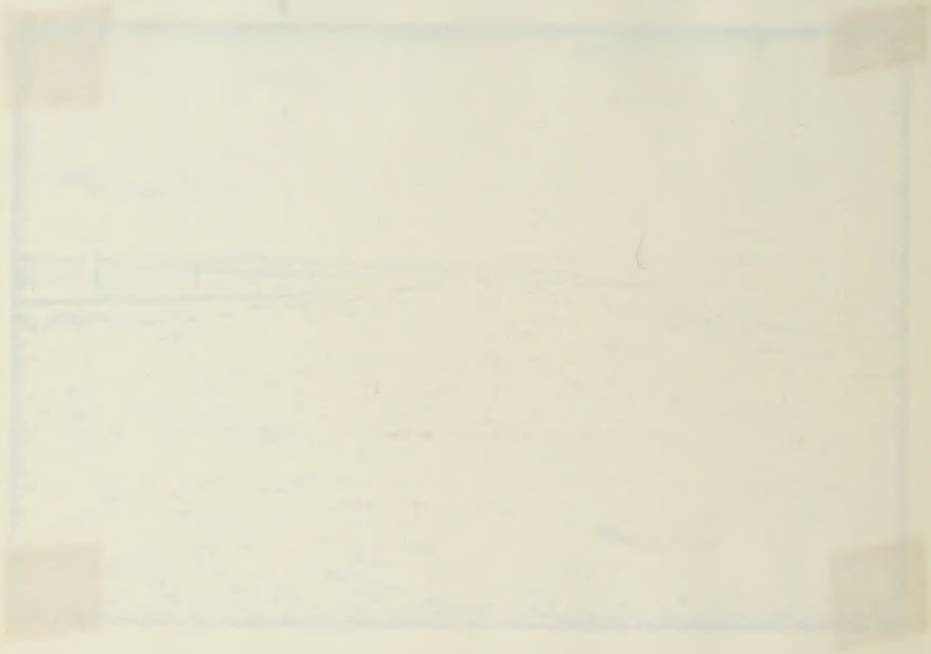
A new Rural Electrification Association (REA) power line has just been completed (early 1971) by Mt. Wheeler Power Company, which supplies power

to the Currant, Duckwater, and Blue Eagle areas. Previous to this, any power generation was done on individual basis.

Telephone service is available at Currant and plans are being made to extend the lines into Duckwater and Blue Eagle.

PHOTO 31

New REA distribution line between Currant and Duckwater.



DUCKWATER

PLAN

APPENDICES

APPENDIX A

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APPENDIX B

SOILS

DATA

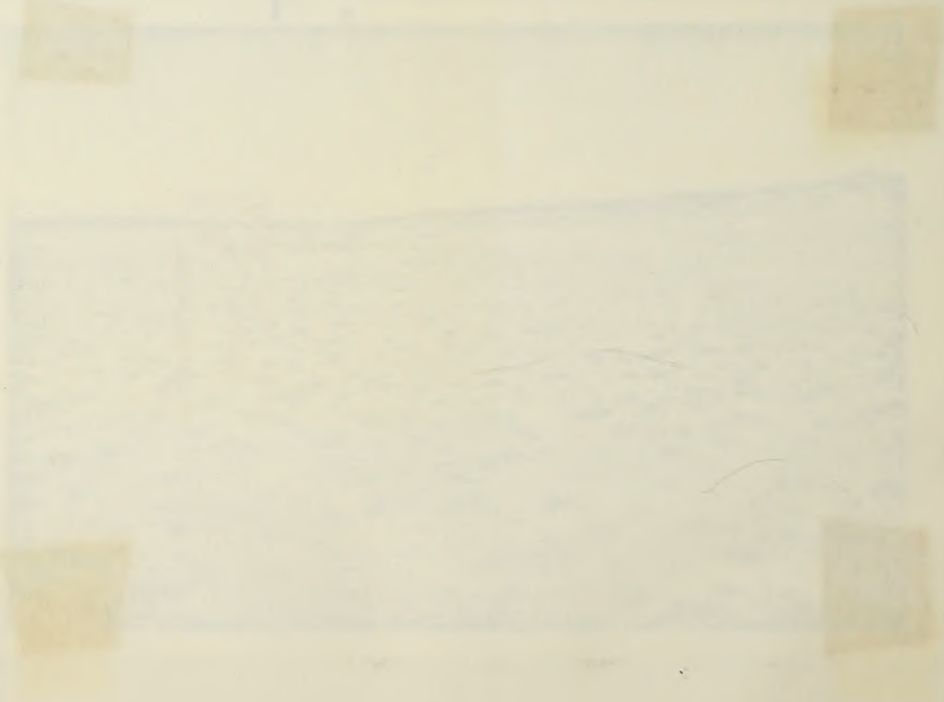
SOIL MAPPING UNIT DESCRIPTIONS

The primary purpose of the soils map (Map #9) and the following descriptions is to provide general information about the soils found within the watershed.

GROUP A1 Torrifluvents, 0-4% slopes. These soils occur in the relatively young, long, and narrow alluviated floodplains of Bull Creek, Duckwater Creek, Little Smokey Valley, and several smaller drainages. These floodplain soils will be overflowed regularly and white sage (Eurotia lanata) is the dominant shrub on the site.

PHOTO 32

White sage (winterfat) occurs primarily on the narrow alluviated floodplains and is often overflowed by flood water. vegetation-soil unit 3100.



These soils are deep, well-drained, loamy textured, light colored, and alkaline. There is no horizon development though they commonly show stratification. There are no root impeding horizons.

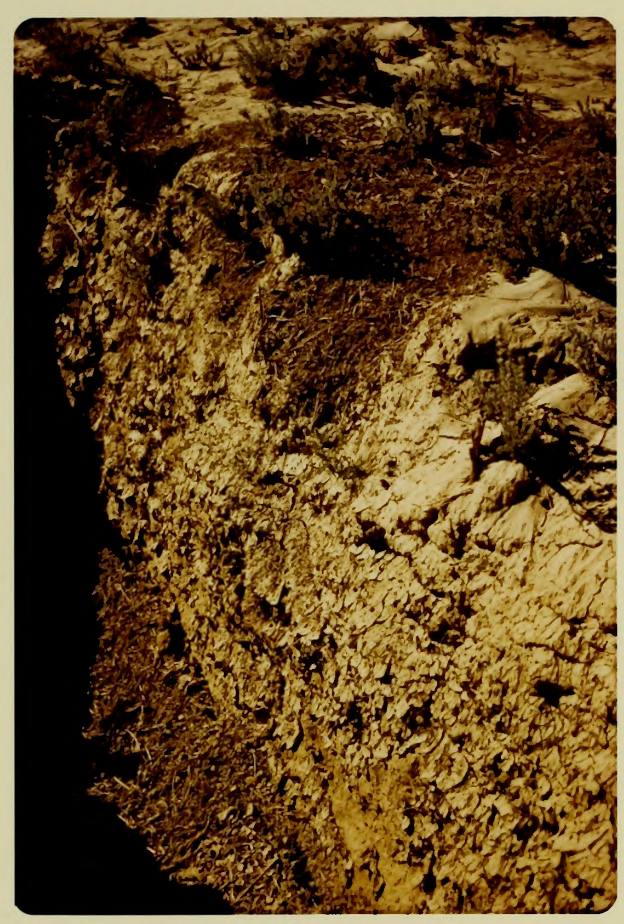


PHOTO 33

White sage occurs on deep, well-drained, loamy textured, light-colored, alkaline soils. Vegetation-soil unit 3100.

GROUP A2 - Torrifluvents - Torriothents, 0-2% slopes. These soils occupy the valley floor of Railroad Valley southwest of Currant, Nevada. They are very deep, moderately to poorly drained, stratified loam and clay loam soils that are salt and alkali affected. Black greasewood (Sarcobatus vermiculatus) is the dominant vegetation.

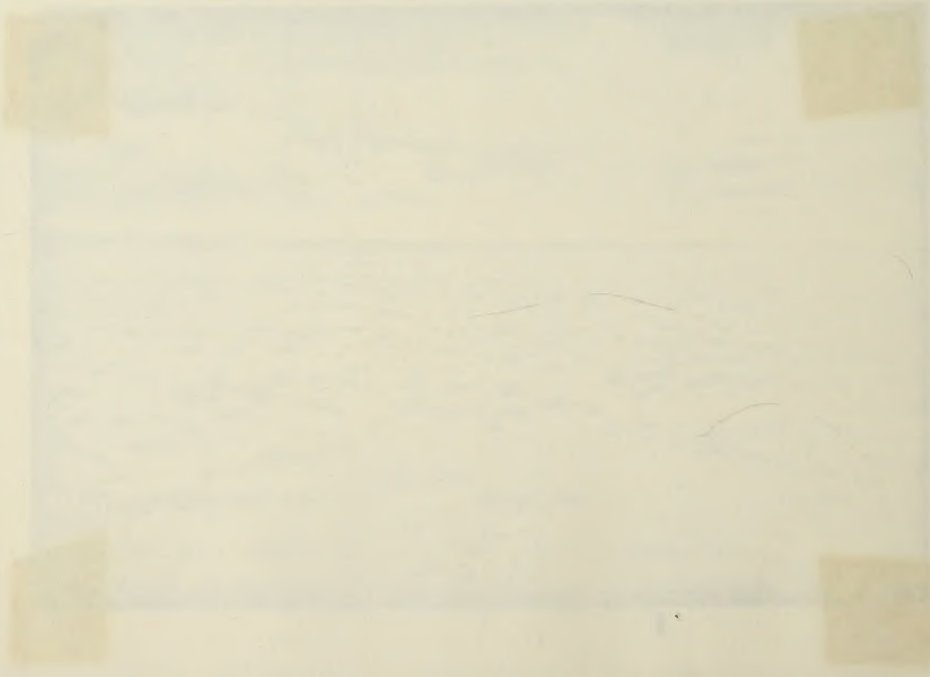
GROUP B1 - Camborthids - Nadurargids, 0-8% slope. These soils occur on the smooth lower alluvial fan piedmonts west of Green Springs and along the west front of the White Pine Mountains.

Camborthids are composed of nearly level and gently sloping, deep, well-drained, loamy soils, underlain by a weak layer of cemented silica. Shadscale (Atriplex confertifolia) and Bailey greasewood (Sarcobatus bailveii) are the dominant vegetation.

Nadurargids consist of level and gently sloping, shallow, moderately drained, clay-loam soils over a restrictive layer or duripan. They are alkali affected in their subsoils. Shadscale is the dominant vegetation.

PHOTO 34

Shadscale occurs on B1 soils in the project area.



GROUP B2 - Durargids - Nadurargids, 0-15% slopes. These soils occur on the slightly to moderately dissected alluvial fan piedmonts: (1) below the Pancake Range and west of the Duckwater Indian Reservation, (2) southeast of Currant, Nevada, and (3) in Sand Springs Valley.

The Durargids and Nadurargids occur in complexes across the fan piedmont with no distinguishable boundaries. Black sagebrush (Artemisia nova), big sagebrush (A. tridentata), shadscale, rabbitbrush (Chrysothamnus spp.), and horsebrush (Tetradymia spp.) occur on these soils.

The soils are all well-drained with light-colored loam or sandy-loam surface horizons and clay-loam or clay subsoils about 11 to 20 inches deep over duripans. The soils are moderately to strongly alkaline with sodium-affected subsoils.

GROUP B3 - Durargids, 2-15% slopes. These soils occur on moderately dissected to smooth, old alluvial fan piedmonts of the higher mountain valleys within the volcanic Pancake and Grant Ranges.

Pinyon-Juniper (Pinus monophylla and Juniperus osteosperma) and black sagebrush are prominent on these soils. (See photo #9)

These soils are shallow, well-drained, with light-colored, thin, loam surface horizons and sandy clay loam to clay loam subsoils over silica cemented hardpans at 7 to 20 inches depth. Reaction in the surface is slightly alkaline and the lower subsoil reaches moderately alkaline.

GROUP B4 - Durorthids - Durargids, 2-15% slopes. These soils occur on the broad, smooth alluvial fan piedmonts (east of the middle reach of Duckwater Creek) and on dissected and broadly rounded, upper alluvial fan piedmonts (along west front of the White Pine Mountains).

Shadscale is dominant over the entire area with blacksage more common on the Haplic Durargids.

The soils are well-drained and shallow to a pan which will interfere with root and water penetration. The Durorthids have a light colored, sandy loam, gravelly loam, or loam textured surface horizons and subsoils over cemented duripans at 11 to 20 inches depth. The Haplic Durargids have a light colored, sandy loam surface horizons and loam to clay-loam subsoils over a somewhat weakly cemented duripan at 11 to 20 inches depth.

GROUP B5 - Durargids - Haplargids, 4-30% slopes. These soils occur on low, smoothly rounded mountains of volcanic rocks and smoothly rounded, old dissected rock pediments and alluvial fans east and west of Duckwater, Nevada, and along west flank of the White Pine Mountains.

Black sagebrush and Galleta grass (Hilaria jamesii) are the dominating vegetation.

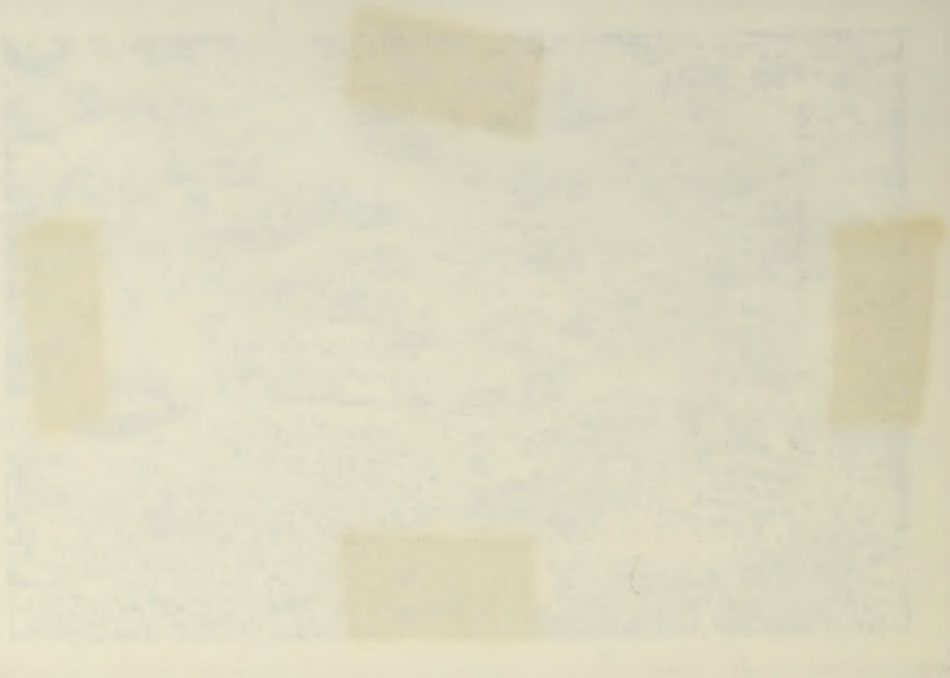
The soils are well-drained, shallow and stoney. Depths to duripans or bedrock are commonly 7 to 12 inches. They have thin, light colored, loam to clay surface horizons and clay loam to clay textured subsoils. The soils are moderately to very strongly alkaline.

PHOTO 35

A typical black sage subtype occurring on low smoothly rounded mountains of volcanic rock in the B5 soil group.

GROUP B6 - Natrargids, 0-2% slopes. These soils occur in the nearly level, smooth basin-fill plain and peripheral alluvial fan toeslopes in Railroad Valley west of Currant, Nevada, and in Fish Creek Valley northwest of Pogue's Station.

The soils are 11-20" deep to duripan or bedrock, moderately to poorly drained and textures range from fine loamy to fine. The dominant vegetation on these saline soils is shadscale and upland greasewood.



GROUP C1 - Cryoborolls, 30-75% slopes. These soils occur in the Pancake, Hot Creek, and Grant Mountain Ranges above 7,000 feet elevation. The soils are rocky, composed of steep and very steep, shallow and very shallow, somewhat excessively drained, gravelly, loamy soils over bedrock. Rock outcrop and bedrock comprise 20% of the area. Pinyon pine is the dominant vegetation, but juniper may be important in the lower elevations. (See photo #4).

GROUP C2 - Durixerolls, 0-15% slopes. These soils occur in the high elevation valleys such as Little Smokey Valley in the western part of the unit. They are composed of nearly level to moderately sloping, well drained, moderately deep to shallow, clayey and loamy soils over duripans. Big sagebrush is the dominant vegetation. (See photo #8).

APPENDIX C

CLIMATOLOGICAL DATA

TABLE 3
CLIMATOLOGICAL DATA*

	Fish Creek Ranch	Duckwater	Currant Hwy. Station	Snowball	Bull Creek Ranch
Elevation	6050 ft.	5400 ft.	6100 ft.	7160 ft.	5900 ft.
Record Years	1944-1966	1966-Present	1962-Present	1965-Present	1963-1965
Precipitation					
Years of Record	22	5	8	5	3
Mean Annual	5.88	7.49	8.30	10.34	8.69
Mean April - Sept.	3.22	4.57	4.51	6.93	5.56
April - Sept. % of total	55	61	54	67	64
Mean Maximum	.62 (May)	1.59 (June)	1.51 (April)	1.66 (June)	1.50 (Apr.)
Mean Minimum	.30 (Feb.)	.03 (Nov.)	.42 (Jan.)	.20 (Oct.)	.31 (Feb.)
Temperature					
Years of Record	22	5	8	5	3
Mean Annual Degrees F	42.2	49.4	44.0	43.8	45.7
Mean Coldest Degrees F	20.1 (Jan.)	29.3 (Dec.)	25.6 (Jan.)	25.9 (Dec.)	25.9 (Jan.)
Mean Warmest Degrees F	64.1 (July)	72.3 (July)	67.9 (July)	64.7 (July)	66.8 (July)
Extreme High Degrees F	99.0 (July)	98.0 (July)	92.0 (June)	87.0 (July)	-
Extreme Low Degrees F	-34.0 (Jan.)	-	-22.0 (Dec.)	-12.0 (Dec.)	-
Average Last Killing Frost in Spring	June 10	May 15	May 22	June 30	
Average First Killing Frost in Fall	Aug. 29	Sept. 21	Aug. 21	Aug. 22	-
Average Growing Season (Days)	80	125	91	53	-

*Source of Information: U. S. Department of Commerce, Weather Bureau Records

APPENDIX C

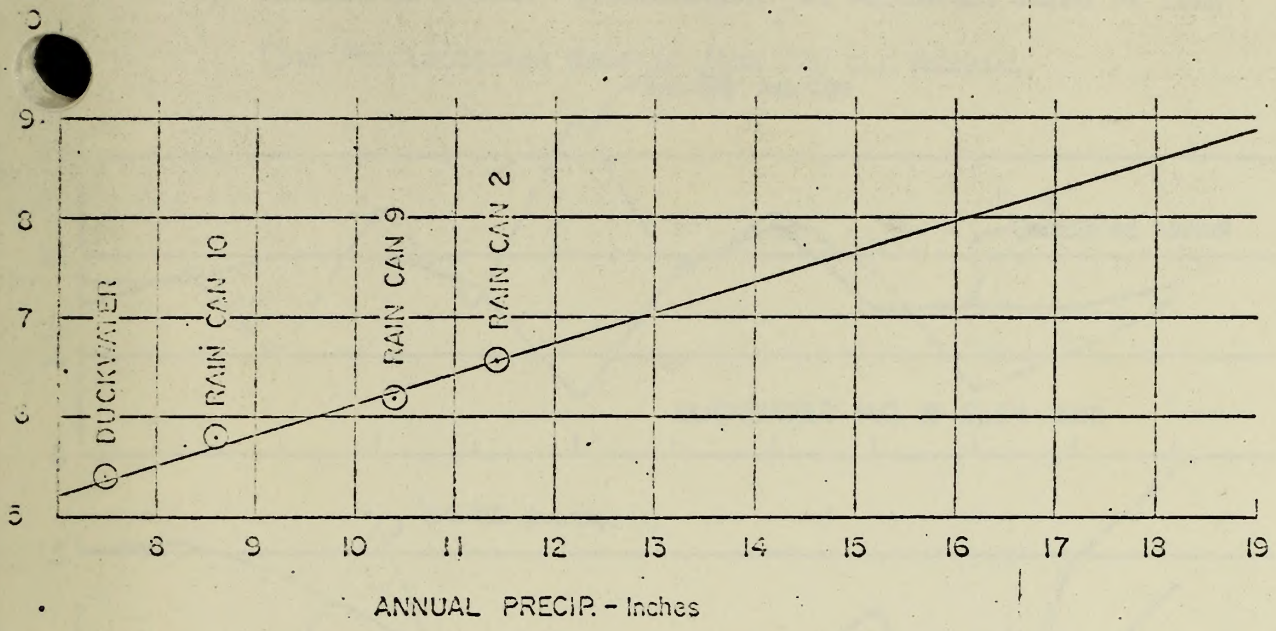
Orographic lifting in the Duckwater Unit for some types of storms is evident (Figure 4). If the effect of orographic lifting is constant, annual rainfall may average 19" annually at elevations above 9,000 feet.

Utilizing the Desert Research Institute publication "Characteristics of Rainfall in the Great Basin", the anticipated long term normal rainfall curve was calculated for Rain Can #19, Duckwater Hydro, and Rain Can #1, Steptoe Hydro; the results are shown as solid lines on Figure 5. Plotted on the same graph is the actual 1964-1969 rainfall shown as a dashed line. From Weather Bureau Climatological Data, the long term rainfall was plotted as a solid line and the 1964-1969 average rainfall was plotted as a dashed line for two stations, Ely A. P. (31 years) and Adaven (55 years).

Since the 1964-1969 curves (dashed lines) all reflect the same shape and the calculated long term curves for Steptoe and Duckwater and the actual long term curves (solid lines) reflect the same shape differing only in magnitude, we can assume they all have common moisture sources and that the shape of the long term normal annual rainfall curve will approach the shape of the calculated curve for the Duckwater area.

During the time period 1964-1969, Ely averaged 2.35 inches more than normal rainfall and Adaven averaged .59 inches below normal rainfall. We may assume that Duckwater received about normal rainfall during this period, however during this period, 1964-1969, Duckwater received considerable above-normal rainfall in June and less than normal rainfall during October.

FIGURE 4

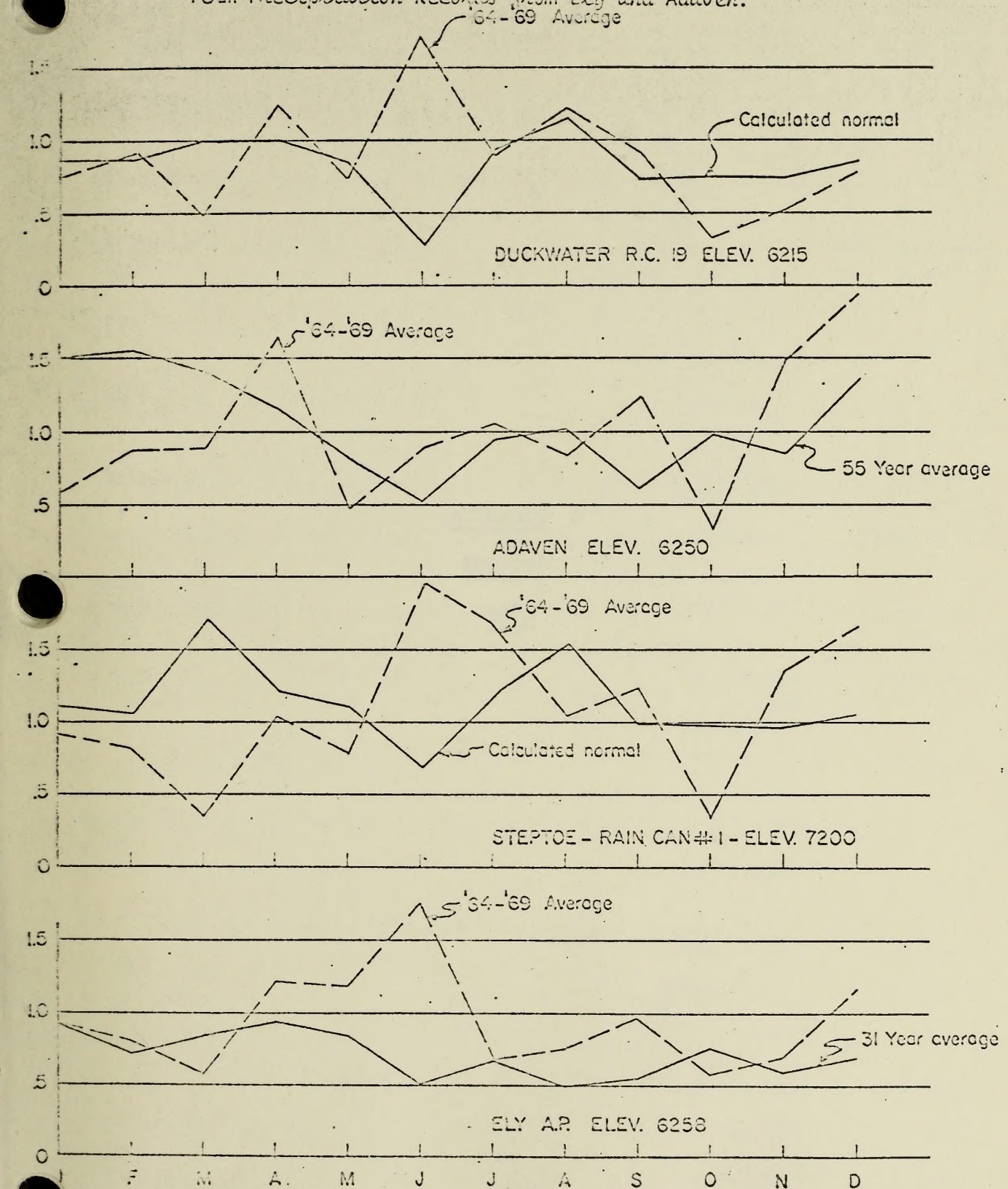


OROGRAPHIC LIFTING IN DUCKWATER UNIT

*No actual data is available for areas above 7,000 feet in the project area. Precipitation in the higher elevations must be extrapolated from other areas.

FIGURE 5

Calculated Normal Precipitation for Duckwater Based on Long Term Precipitation Records from Ely and Adaven.



APPENDIX D

ECONOMIC

DATA

TABLE 4 8/

ESTIMATED VALUE OF 1970 CROP FOR DUCKWATER

Crop	Reported Acres	Average Yield Reported	Calculated Production	Average Value Per Ton	Total
Alfalfa Hay	784	3.027	2,373.46	26.06	61,852.37
Native Hay	1,869	1.68	3,173.52	21.81	69,214.47
Pasture	3,858	0.76	2,929.0	21.81	63,881.49
Total	6,531		8,475.98		194,948.85

TABLE 5

COMPARISON OF LAND OWNERSHIP AND ADMINISTERING AGENCY NEVADA/DUCKWATER

Land Ownership & Administering Agency	Nevada	Duckwater
Department of Agriculture		
Forest Service	5,073,657	
Department of the Interior		
Bureau of Land Management	48,067,092	777,660
National Park Service	254,358	
Bureau of Reclamation	1,170,548	
Fish & Wildlife Service	2,185,227	
Bureau of Indian Affairs	7,810	3,200
Atomic Energy Commission	817,659	
Department of Defense	3,146,494	
Federal Aviation Administration	2,159	
	60,725,004	780,860
State and Local	14,053	
Private	9,525,953	10,680
Total State & Private	9,540,006	10,680
TOTAL	70,265,010	791,540

APPENDIX E

WATERSHED CONSERVATION OBJECTIVES

The conservation objective is to stabilize the soil resource to the extent that is physically practical in the vegetation-soil units and vegetation planning elements by increasing vegetative cover to reduce soil surface factor (SSF) from present to objective as shown in Table 6 for Segment A and Table 7 for Segments B and C.

TABLE 6

FEASIBLE DECREASE IN SOIL SURFACE FACTORS (SSF) REQUIRED TO MEET THE CONSERVATION OBJECTIVE IN SEGMENT A (by vegetation-soil unit)

VEGETATION-SOIL UNIT	ACRES	SSF	
		PRESENT	OBJECTIVE
Eula Hagl/3100	4400	54	47
Saba Hija Atco/3150	4690	33	31
Atco Hija Chst/3200	22300	38	26
Arno Atco Chst/3230	2230	45	42
Artr Eula Arno/3300	3000	45	41
Arno Artr Stco/3310	7650	43	39
Arno Chst Eula/3320	6200	50	42
Arno Artr Juos/3330	8500	54	45
Arno Atco Orhy/3340	3250	34	33
Arno Atco Chst/3350	5090	31	30
Arno Artr Juos/3360	2020	58	53
Artr Arno Chst/3400	1610	66	20
Artr Arno Juos/3450	1660	66	20
Artr Chst Orhy/3470	970	49	20
Artr Hija/3480	1430	38	20
Artr Arno Juos/3490	540	44	20
Arno Artr Atco/3500	7910	54	49
Eula Atco Arno/3600	4150	61	53
Eula Chst Orhy/3610	1770	60	52
Artr Stco Orhy/3700	1690	38	20
Atco Saba Hija/3800	8290	38	31
Juos Artr Arno/3910	3100	68	20
Juos Artr Arno/3920	2610	68	20
Arno Hija/3930	26060	34	32
Juos Arno Cein/3950	20710	47	46
Pimo Juos Arno/3900	22580	47	47
TOTAL	174410		

TABLE 7

FEASIBLE DECREASE IN SOIL SURFACE FACTORS (SSF) REQUIRED TO MEET THE CONSERVATION OBJECTIVE IN SEGMENTS B AND C

(by vegetation-soil unit)

VEGETATION PLANNING ELEMENT	ACRES	SSF	
		PRESENT	OBJECTIVE
012 - Grassland	974	13	13
041 - (1) - Big Sagebrush	44100	36	20
041 - (2) - Big Sagebrush	30965	36	32
042 - Short Sagebrush	2226	27	25
043 - (1) Black Sagebrush	10500	37	20
043 - (2) Black Sagebrush	212681	37	33
044 - Rabbitbrush	12846	33	28
091 - (1) Pinyon-Juniper	13000	40	20
091 - (2) Pinyon-Juniper	89928	40	40
131 - Shadscale	71638	37	33
141 - Greasewood	79766	44	40
151 - White Sage	34626	39	32
TOTAL	603250		

Refer to Map #6 for location of vegetation-soil units and vegetation planning elements.

APPENDIX F

DETAILS OF

ECONOMIC ANALYSIS

CONSERVATION - ECONOMIC ANALYSIS

Economic Analysis of Conservation Phase

Duckwater Watershed - Ely District, Nevada

Analysis Process

The objective of the cost-effectiveness analysis on the conservation phase of the Duckwater Watershed is to find the alternative which yields the greatest effectiveness for any given cost. Effectiveness is used when it is not possible to place a dollar value on the output or performance.

The cost-effectiveness ratio derived from this analysis is an economic indicator of efficiency, computed by dividing effectiveness by cost. The annual amount of effectiveness and costs are discounted so that the ratio reflects efficiency in terms of the present value of future effectiveness and costs.

The analysis process followed for analyzing the cost and effectiveness of jobs or practices needed to meet conservation objectives in the Duckwater Watershed is the "with" and "without" approach. In this approach, the physical effect of what is expected to result with the job or practice is compared to what is expected to take place without the jobs or practices.

The first step in the evaluation is to quantify the number of equivalent stable acres which will be lost "without" alternatives (see Table 8). An equivalent stable acre is a numerical expression used

in cost-effectiveness analyses and is a function of stability and relative productivity of the land.

Next, we quantified the increased number of stable acres which will be produced by alternatives (see Tables 9, 10, & 11).

Since all the stable acres are not produced in the first year, it was necessary to discount them to the present. Tables 12, 13, 14, & 15 show the present value equivalent stable acres produced. The total effectiveness of each alternative was then determined by adding the decrease avoided to the increase in equivalent stable acres. Future without alternative (present value equivalent stable acres) + future with alternative (present value equivalent stable acres). This sum is shown by alternatives on Table 16.

The next step in the analysis process was to estimate the cost of each alternative by determining the present value of the costs based on estimated per unit costs of practices and their effective life (see Table 17).

Incidental development benefits, primarily AUM's and hunter and visitor days, will be produced by a conservation project in the Duckwater Watershed. When such benefits accrue, the effectiveness/cost ratio must be adjusted accordingly. This adjustment was done by subtracting from the present value of total project costs, costs equal to the present dollar value of development benefits, as shown on Table 18. The effectiveness/cost ratio is then determined by dividing the total present value equivalent stable acres produced by the present

value of net costs.

The procedure followed in this analysis is outlined in detail in BLM (draft) Manual 9522--Cost-Effectiveness Analysis. A 5½ percent interest rate was used for discounting purposes in accordance with BLM Instruction Memo No. 69-136, which was in effect when this analysis was prepared.

TABLE 8

Equivalent Stable Acres Lost Without Alternatives

(1) Vegetative Type	(2) Vegetative Soil Unit	(3) Acres	(4) Equivalent Value Factor	(5) Equivalent Acres (3 x 4)	(6) Present % Stable	(7) Present Equivalent Stable Acres (5 x 6)	(8) Future Without % Stable	(9) Future With Alternatives Equivalent Stable Acres (5 x 8)	(10) Decrease Equivalent Stable Acres (7 - 9)
151	3100	4,400	6	26,400	56.25	14,850	50.00	13,200	1,650
141	3150	4,690	16	75,040	81.25	60,970	81.25	60,970	0
131	3200	22,300	16	356,800	75.00	267,600	56.25	200,700	66,900
043	3230	2,230	6	13,380	68.75	9,199	62.50	8,362	837
041	3300	3,000	6	18,000	68.75	12,375	56.25	10,125	2,250
043	3310	7,650	6	45,900	68.75	31,556	68.75	31,556	0
043	3320	6,200	6	37,200	62.50	23,250	50.00	18,600	4,650
043	3330	8,500	6	51,000	56.25	28,688	37.50	19,125	9,563
043	3340	3,250	6	19,500	81.25	15,844	75.00	14,625	1,219
043	3350	5,090	16	81,440	87.50	71,260	81.25	66,170	5,090
043	3360	2,020	6	12,120	50.00	6,060	43.75	5,302	758
041	3400	1,610	16	25,760	43.75	11,270	31.25	8,050	3,220
041	3450	1,660	16	26,560	43.75	11,620	25.00	6,640	4,980
041	3470	970	16	15,520	62.50	9,700	50.00	7,760	1,940
041	3480	1,430	16	22,880	75.00	17,160	68.75	15,730	1,430
041	3490	540	16	8,640	68.75	5,940	43.75	3,780	2,160
043	3500	7,910	6	47,460	56.25	26,696	50.00	23,730	2,966
151	3600	4,150	6	24,900	50.00	12,450	43.75	10,894	1,556
151	3610	1,770	6	10,620	50.00	5,310	43.75	4,646	664
041	3700	1,690	16	27,040	75.00	20,280	75.00	20,280	0
131	3800	8,290	6	49,740	75.00	37,305	68.75	34,196	3,109
091	3900	22,580	16	361,280	68.75	248,380	62.50	225,800	22,580
091	3910	3,100	16	49,600	37.50	18,600	31.25	15,500	3,100
091	3920	2,610	16	41,760	37.50	15,660	31.25	13,050	2,610
043	3930	26,060	6	156,360	81.25	127,042	81.25	127,042	0
091	3950	20,710	6	124,260	68.75	85,429	62.50	77,662	7,767
012		974	28	27,272	100.00	27,272	100.00	27,272	0
041		75,065	28	2,101,820	81.25	1,707,728	75.00	1,576,365	131,363
042		2,226	6	13,356	93.75	12,521	75.00	10,017	2,504
043		223,181	6	1,339,086	81.25	1,088,007	68.75	920,621	167,386
091-1		13,000	28	364,000	75.00	273,000	68.75	250,250	22,750
091-2		89,928	16	1,438,848	75.00	1,079,136	68.75	989,208	89,928
131		71,638	6	429,828	81.25	349,235	68.75	295,507	53,728
141		79,766	6	478,596	68.75	329,035	68.75	329,035	0
151		34,626	6	207,756	75.00	155,817	68.75	142,832	12,985
044		12,846	6	77,076	81.25	62,624	75.00	57,807	4,817
									636,460

TABLE 9

Equivalent Stable Acres Produced With Alternatives

Alternative No. 1

(1) Vegetative Type	(2) Vegetative Soil Unit	(3) Acres	(4) Equivalent Value Factor	(5) Equivalent Acres (3 x 4)	(6) % Stable	(7) Equivalent Stable Acres (5 x 6)	(8) Future With % Stable	(9) Alternatives Equivalent Stable Acres (5 x 8)	(10) Increase Equivalent Stable Acres (9 - 7)
151	3100	4,400	6	26,400	56.25	14,850	62.50	16,500	1,650
141	3150	4,690	16	75,040	81.25	60,970	81.25	60,970	0
131	3200	22,300	16	356,800	75.00	267,600	87.50	312,200	44,600
043	3230	2,230	6	13,380	68.75	9,199	68.75	9,199	0
041	3300	3,000	6	18,000	68.75	12,375	75.00	13,500	1,125
043	3310	7,650	6	45,900	68.75	31,556	75.00	34,425	2,869
043	3320	6,200	6	37,200	62.50	23,250	68.75	25,575	2,325
043	3330	8,500	6	51,000	56.25	28,688	62.50	31,875	3,187
043	3340	3,250	6	19,500	81.25	15,844	81.25	15,844	0
043	3350	5,090	16	81,440	87.50	71,260	87.50	71,260	0
043	3360	2,020	6	12,120	50.00	6,060	56.25	6,818	758
041	3400	1,610	16	25,760	43.75	11,270	43.75	11,270	0
041	3450	1,660	16	26,560	43.75	11,620	37.50	9,960	1,660
041	3470	970	16	15,520	62.50	9,700	68.75	10,670	970
041	3480	1,430	16	22,880	75.00	17,160	81.25	18,590	1,430
041	3490	540	16	8,640	68.75	5,940	68.75	5,940	0
043	3500	7,910	6	47,460	56.25	26,696	62.50	29,662	2,966
151	3600	4,150	6	24,900	50.00	12,450	56.25	14,006	1,556
151	3610	1,770	6	10,620	50.00	5,310	56.25	5,974	664
041	3700	1,690	16	27,040	75.00	20,280	81.25	21,970	1,690
131	3800	8,290	6	49,740	75.00	37,305	81.25	40,414	3,109
091	3900	22,580	16	361,280	68.75	248,380	68.75	248,380	0
091	3910	3,100	16	49,600	37.50	18,600	37.50	18,600	0
091	3920	2,610	16	41,760	37.50	15,660	43.75	18,270	2,610
043	3930	26,060	6	156,360	81.25	127,042	81.25	127,042	0
091	3950	20,710	6	124,260	68.75	85,429	68.75	85,429	0
012		974	28	27,272	100.00	27,272	100.00	27,272	0
041		75,065	28	2,101,820	81.25	1,707,728	81.25	1,707,728	0
042		2,226	6	13,356	93.75	12,521	93.75	12,521	0
043		223,181	6	1,339,086	81.25	1,088,007	81.25	1,088,007	0
091-1		13,000	28	364,000	75.00	273,000	75.00	273,000	0
091-2		89,928	16	1,438,848	75.00	1,079,136	75.00	1,079,136	0
131		71,638	6	429,828	81.25	349,235	81.25	349,235	0
141		79,766	6	478,596	68.75	329,035	68.75	329,035	0
151		34,626	6	207,756	75.00	155,817	75.00	155,817	0
044		12,846	6	77,076	81.25	62,624	87.50	67,441	4,817
									77,986

Table 10

Equivalent Stable Acres Produced With Alternatives

Alternative No. 2

(1) Vegetative Type	(2) Vegetative Soil Unit	(3) Acres	(4) Equivalent Value Factor	(5) Equivalent Acres (3X4)	(6) Present % Stable	(7) Present Equivalent Stable Acres (5X6)	(8) Future With Alternatives % Stable	(9) Future With Alternatives Equivalent Stable Acres (5X8)	(10) Increase Equivalent Stable Acres (9-7)
151	3100	4,400	6	26,400	56.25	14,850	68.75	18,150	3,300
141	3150	4,690	16	75,040	81.25	60,970	87.50	65,660	4,690
131	3200	22,300	16	356,800	75.00	267,600	93.75	334,500	66,900
043	3230	2,230	6	13,380	68.75	9,199	75.00	10,035	836
041	3300	3,000	6	18,000	68.75	12,375	75.00	13,500	1,125
043	3310	7,650	6	45,900	68.75	31,556	75.00	34,425	2,869
043	3320	6,200	6	37,200	62.50	23,250	75.00	27,900	4,650
043	3330	8,500	6	51,000	56.25	28,688	68.75	35,062	6,374
043	3340	3,250	6	19,500	81.25	15,844	81.25	15,844	0
043	3350	5,090	16	81,440	87.50	71,260	87.50	71,260	0
043	3360	2,020	6	12,120	50.00	6,060	56.25	6,813	753
041	3400	1,610	16	25,760	43.75	11,270	50.00	12,880	1,610
041	3450	1,660	16	26,560	43.75	11,620	37.50	9,960	0
041	3470	970	16	15,520	62.50	9,700	68.75	10,670	970
041	3480	1,430	16	22,880	75.00	17,160	81.25	18,590	1,430
041	3490	540	16	8,640	68.75	5,940	75.00	6,480	540
043	3500	7,910	6	47,460	56.25	26,696	62.50	29,662	2,966
151	3600	4,150	6	24,900	50.00	12,450	56.25	14,006	1,556
151	3610	1,770	6	10,620	50.00	5,310	62.50	6,638	1,328
041	3700	1,690	16	27,040	75.00	20,280	81.25	21,970	1,690
131	3800	8,290	6	49,740	75.00	37,305	87.50	43,522	6,217
091	3900	22,580	16	361,280	68.75	248,380	68.75	248,380	0
091	3910	3,100	16	49,600	37.50	18,600	43.75	21,700	3,100
091	3920	2,610	16	41,760	37.50	15,660	56.25	23,490	7,830
043	3930	26,060	6	156,360	81.25	127,042	87.50	136,815	9,773
091	3950	20,710	6	124,260	68.75	85,429	68.75	85,429	0
012		974	28	27,272	100.00	27,272	100.00	27,272	0
041		75,065	28	2,101,820	81.25	1,707,728	87.50	1,839,092	131,364
042		2,226	6	13,356	93.75	12,521	93.75	12,521	0
043		223,181	6	1,339,086	81.25	1,088,007	81.25	1,088,007	0
091-1		13,000	28	[illegible],000	75.00	273,000	75.00	273,000	0
091-2		89,928	16	1,[illegible]8,848	75.00	1,079,136	75.00	1,079,136	0
131		71,633	6	429,828	81.25	349,235	81.25	349,235	0
141		79,766	6	478,596	68.75	329,035	75.00	358,947	29,912
151		34,626	6	207,756	75.00	155,817	87.50	181,786	25,969
044		12,846	6	77,076	81.25	62,624	87.50	67,442	4,818
									232,575

Table 11

Equivalent Stable Acres Produced With Alternatives

Alternative No. 3

(1) Vegetative Type	(2) Vegetative Soil Unit	(3) Acres	(4) Equivalent Value Factor	(5) Equivalent Acres (3X4)	(6) Present % Stable	(7) Present Equivalent Stable Acres (5X6)	(8) Future With Alternatives % Stable	(9) Alternatives Equivalent Stable Acres (5X8)	(10) Increase Equivalent Stable Acres (9-7)
151	3100	4,400	6	26,400	56.25	14,850	68.75	18,150	3,300
141	3150	4,690	16	75,040	81.25	60,970	87.50	65,660	4,690
131	3200	22,300	16	356,000	75.00	267,600	93.75	334,500	66,900
043	3230	22,230	6	13,380	68.75	9,199	75.00	10,035	836
041	3300	3,000	6	18,000	68.75	12,375	75.00	13,500	1,125
043	3310	7,650	6	45,900	68.75	31,556	75.00	34,425	2,869
043	3320	6,200	6	37,200	62.50	23,250	75.00	27,900	4,650
043	3330	8,500	6	51,000	56.25	28,688	68.75	35,062	6,374
043	3340	3,250	6	19,500	81.25	15,844	81.25	15,844	0
043	3350	5,090	16	81,440	87.50	71,260	87.50	71,260	0
043	3360	2,020	6	12,120	60.00	6,060	56.25	6,818	758
041	3400	610	16	9,760	43.75	4,270	50.00	4,880	610
041	3400	1,000	16	16,000	43.75	7,000	100.00	16,000	9,000
041	3470	970	16	15,520	62.50	9,700	100.00	15,520	5,820
041	3	1,430	16	22,880	75.00	17,160	100.00	22,880	5,720
041	34	540	16	8,640	68.75	5,940	100.00	8,640	2,700
043	-	7,910	6	47,460	56.25	26,696	62.50	29,662	2,966
151		4,150	6	24,900	50.00	12,450	56.25	14,006	1,556
151	0	1,770	6	10,620	50.00	5,310	62.50	6,638	1,328
041	3700	690	16	11,040	75.00	8,280	81.25	8,970	690
041	3700	1,000	16	16,000	75.00	12,000	100.00	16,000	4,000
131	3800	8,290	6	49,740	75.00	37,305	87.50	43,522	6,217
091	3900	22,580	16	361,280	68.75	248,380	68.75	248,380	0
041	3450	1,160	16	18,560	43.75	8,120	37.50	6,960	0
041	3450	500	16	8,000	43.75	3,500	100.00	8,000	4,500
091	3910	900	16	14,400	37.50	5,400	43.75	6,300	900
091	3910	2,200	16	35,200	37.50	13,200	100.00	35,200	22,000
091	3920	810	16	12,960	37.50	4,860	56.25	7,290	2,430
091	20	1,800	16	28,800	37.50	10,800	100.00	28,800	18,000
043	30	26,060	6	156,360	81.25	127,042	87.50	136,815	9,773
091	3950	20,710	6	124,260	68.75	85,429	68.75	85,429	0
012		974	28	27,272	100.00	27,272	100.00	27,272	0
041-1		44,100	28	1,234,800	81.25	1,003,275	100.00	1,234,800	231,525
041-2		30,965	28	867,020	81.25	704,453	87.50	758,642	54,189
042		2,226	6	13,356	93.75	12,521	93.75	12,521	0
043-1		10,500	6	63,000	81.25	51,188	100.00	63,000	11,812
043-2		212,881	6	1,276,086	81.25	1,036,819	81.25	1,036,819	0
091-1		13,000	28	364,000	75.00	273,000	100.00	364,000	91,000
091-2		80,928	16	1,438,848	75.00	1,079,136	75.00	1,079,136	0
131		71,638	6	429,828	81.25	349,235	81.25	349,235	0
141		79,766	6	478,596	68.75	329,035	75.00	358,947	29,912
151		34,626	6	207,756	75.00	155,817	87.50	181,786	25,969
044		12,846	6	77,076	81.25	62,624	87.50	67,442	4,818
									638,937

Table 12

Present Value

Equivalent Stable Acres Without Alternatives

(1) Vegetative Type	(2) Vegetative Soil Units	(3) Decrease Equivalent Stable Acres	(4) Years	(5) Future Without Alternatives Average Equivalent Sta. Acres (3÷4)	(6) Present 1 per year Factor	(7) Present Equivalent Sta. Acres (5X6)
151	3100	1,650	15	110	10.038	1,104.2
141	3150	0		0		0
131	3200	66,900		4,460		44,769.5
043	3230	837		55.8		560.1
041	3300	2,250		150		1,505.7
043	3310	0		0		0
043	3320	4,650		310		3,111.8
043	3330	9,563		637.5		6,399.2
043	3340	1,219		81.3		816.1
043	3350	5,090		339.3		3,405.9
043	3360	758		50.5		506.9
041	3400	3,220		214.7		2,155.2
041	3450	4,980		332		3,332.6
041	3470	1,940		129.3		1,297.9
041	3480	1,430		95.3		956.6
041	3490	2,160		144		1,445.5
043	3500	2,966		197.7		1,984.5
151	3600	1,556		103.7		1,040.9
151	3610	664		44.3		444.7
041	3700	0		0		0
131	3800	3,109		207.3		2,080.9
091	3900	22,580		1,505.3		15,110.2
091	3910	3,100		206.7		2,074.8
091	3920	2,610		174		1,746.6
043	3930	0		0		0
091	3950	7,767		517.8		5,197.7
012		0		0		0
041		131,363		8,757.5		87,907.8
042		2,504		166.9		1,675.3
043		167,386		11,159.1		112,015.0
091-1		22,750		1,516.7		15,224.6
091-2		89,928		5,995.2		60,179.8
13.		53,728		3,581.9		35,955.1
141		0		0		0
151		12,985		865.6		8,688.9
045		4,817		321.1		3,223.2
						425,917.2

Table 13

Present Value

Equivalent Stable Acres Produced

(1) Vegetative Type	(2) Vegetative Soil Units	(3) Increase Equivalent Stable Acres	(4) Years	(5) Future With Alternative Average Equivalent Sta. Acres (3÷4)	(6) Present 1 per year Factor	(7) Present Equivalent Sta. Acres (5X6)
151	3100	1,650	2	825	1.846	1,522.9
141	3150	0	0	0	0	0
131	3200	44,600	8	5,575	6.334	35,312.1
043	3230	0	2	0	1.846	0
041	3300	1,125	4	281.2	3.505	985.6
043	3310	2,869	2	1,434.5	1.846	2,648.1
043	3320	2,325	6	387.5	4.996	1,935.9
043	3330	3,187	6	531.2	4.996	2,653.9
043	3340	0	0	0	0	0
043	3350	0	0	0	0	0
043	3360	753	4	189.5	3.505	664.2
041	3400	0	1	0	.948	0
041	3450	1,660	15	110.7	10.038	1,111.2
041	3470	970	2	485	1.846	895.3
041	3480	1,430	1	1,430	.948	1,355.6
041	3490	0	1	0	.948	0
043	3500	2,966	2	1,483	1.846	2,737.6
131	3600	1,556	6	259.3	4.996	1,295.5
151	3610	664	6	110.7	4.996	553.1
041	3700	1,690	2	845	1.846	1,559.9
131	3800	3,109	4	777.2	3.505	2,724.1
091	3900	0	0	0	0	0
091	3910	0	0	0	0	0
091	3920	2,610	2	1,305	1.846	2,409.0
043	3930	0	1	0	.948	0
091	3950	0	0	0	0	0
012		0	0	0	0	0
041		0	1	0	.948	0
042		0	0	0	0	0
043		0	1	0	.948	0
091		0	15	0	10.038	0
131		0	1	0	.948	0
141		0	1	0	.948	0
151		0	1	0	.948	0
045		4,817	1	4,817	.948	4,566.5
						64,930.5

Table 14

Present Value

Equivalent Stable Acres Produced

Alternative No. 2

(1) Vegetative Type	(2) Vegetative Soil Units	(3) Increase Equivalent Stable Acres	(4) Years	(5) Future With Alternative Average Annual Equivalent Sta. Acres (3÷4)	(6) Present Value 1 per year Factor	(7) Present Value Equivalent Sta. Acres (5X6)
151	3100	3,300	7	471.4	5.683	2,678.9
141	3150	4,690	1	4,690	.948	4,446.1
131	3200	66,900	8	8,362.5	6.334	52,968.1
043	3230	836	4	209	3.505	732.5
041	3300	1,125	5	225	4.270	960.8
043	3310	2,869	5	573.8	4.270	2,450.1
043	3320	4,650	8	581.2	6.334	3,681.3
043	3330	6,374	8	796.8	6.334	5,046.9
043	3340	0	0	0	0	0
043	3350	0	0	0	0	0
043	3360	758	6	126.3	4.996	631.0
041	3400	1,610	4	402.5	3.505	1,410.8
041	3450	0	15	0	10.038	0
041	3470	970	4	242.5	3.505	849.9
041	3480	1,430	3	476.7	2.698	1,286.1
041	3490	540	2	270	1.846	498.4
043	3500	2,966	6	494.3	4.996	2,469.5
151	3600	1,556	8	194.5	6.334	1,231.9
151	3610	1,328	8	166	6.334	1,051.4
041	3700	1,690	2	845	1.846	1,559.9
131	3800	6,217	7	888.1	5.683	5,047.1
091	3900	0	0	0	0	0
091	3910	3,100	5	620	4.270	2,647.4
091	3920	7,830	9	870	6.952	6,048.2
043	3930	9,773	2	4,886.5	1.846	9,020.5
091	3950	0	1	0	.948	0
012		0	0	0	0	0
041		131,364	4	32,841	3.505	115,107.7
042		0	2	0	1.846	0
043		0	5	0	4.270	0
091		0	0	0	0	0
131		0	5	0	4.270	0
141		29,912	5	5,982.4	4.270	25,544.8
151		25,969	7	3,709.8	5.683	21,082.8
045		4,818	6	803.0	4.996	4,011.8
						272,463.9

Present Value

Equivalent Stable Acres Produced

Alternative No. 3

(1) Vegetative Type	(2) Vegetative Soil Units	(3) Increase Equivalent Stable Acres	(4) Years	(5) Future With Alternative Average Annual Equivalent Sta. Acres (3÷4)	(6) Present Value 1 per year Factor	(7) Present Value Equivalent Sta. Acres (5X6)
151	3100	3,300	7	471.4	5.683	2,678.9
141	3150	4,690	2	2,345	1.846	4,328.9
131	3200	66,900	8	8,362.5	6.334	52,968.1
043	3230	836	4	209	3.505	732.5
041	3300	1,125	5	225	4.270	960.8
043	3310	2,869	5	573.8	4.270	2,450.1
043	3320	4,650	8	581.2	6.334	3,681.3
043	3330	6,374	8	796.8	6.334	5,046.9
043	3340	0	1	0	.948	0
043	3350	0	1	0	.948	0
043	3360	758	6	126.3	4.996	631.0
041	3400	610	4	152.5	3.505	534.5
041	3400	9,000	4	2,250	3.505	7,886.2
041	3470	5,820	4	1,455	3.505	5,099.8
041	3480	5,720	3	1,906.7	2.698	5,144.3
041	3490	2,700	2	1,350	1.846	2,492.1
043	3500	2,966	6	494.3	4.996	2,469.5
151	3600	1,556	8	194.5	6.334	1,231.9
151	3610	1,328	8	166	6.334	1,051.4
041	3700	690	2	345	1.846	636.9
041	3700	4,000	4	1,000	3.505	3,505.0
131	3800	6,217	7	888.1	5.683	5,047.1
091	3900	0	0	0	0	0
041	3450	0	15	0	10.038	0
041	3450	4,500	4	1,125	3.505	3,943.1
091	3910	900	5	180	4.270	768.6
091	3910	22,000	4	5,500	3.505	19,277.5
091	3920	2,430	9	270	6.952	1,877.0
091	3920	18,000	4	4,500	3.505	15,772.5
043	3930	9,773	2	4,886.5	1.846	9,020.4
091	3950	0	1	0	.948	0
012		0	0	0	0	0
041		231,525	4	57,881.2	3.505	202,873.6
041		54,189	4	13,547.2	3.505	47,482.9
042		0	2	0	1.846	0
043		11,812	4	2,953	3.505	10,350.3
043		0	5	0	4.270	0
091		91,000	4	22,750	3.505	79,738.8
091		0	0	0	0	0
131		0	5	0	4.270	0
141		29,912	5	5,982.4	4.270	25,544.8
151		25,969	7	3,709.8	5.683	21,082.8
045		4,818	6	803	4.996	4,011.8
						550,321.3

Table 16

Present Value Equivalents

Acres Stabilized

(1) Alternative	(2) Future Without Alternative Equivalent Stable Acres	(3) Future With Alternative	(4) Total Equivalent Stable Acres (2+3)
No. 1	425,917.2 1/	64,930.5 2/	490,848
No. 2	425,917.2	272,463.9 3/	698,381
No. 3	425,917.2	550,321.3 4/	976,238

1/ Total Column 7, Table V

2/ Total Column 7, Table VI

3/ Total Column 7, Table VII

4/ Total Column 7, Table VIII

Table 17

Estimated Cost of Alternatives

(Dollars)

Practice	Initial Cost	Years	Present Value of 1 Factor 5½%	Present Value Cost	Replacement Cost	Years	Present Value of 1 Factor 5½%	Present Value Cost	O&M	Years	Annuity Factor 5½%	Present Value Cost	Total Present Value Cost
Alternative No. 1													
Fence	333,000	5	.7651344	254,789					11,100	50	16.9315179	187,940	442,729
Pipeline	283,500	5	.7651344	216,916	283,500	26	.2485628	70,468	18,900	50		320,006	607,390
Spring Dev.	106,500	5	.7651344	81,487					1,650	50		27,937	109,424
Catchments	600,000	5	.7651344	459,081					20,000	50		338,630	797,711
Reservoirs	21,000	5	.7651344	16,068					700	50		11,852	27,920
Wells	70,000	5	.7651344	53,559					1,000	50		16,932	70,491
Seedings - Artr	---	-							---	--			
Seedings - PJ	---	-							---	--			
Study Plots	6,000	5	.7651344	4,591					300	50		5,079	9,670
Trails	90,000	5	.7651344	68,862					8,200	50		138,839	207,701
Man-Months	334,400	5	.7651344	255,861					28,600	50		484,241	740,102
									Alternative No. 1 Total				3,013,139
Alternative No. 2													
Fence	502,500	5	.7651344	384,480					16,750	50		283,603	668,083
Pipeline	298,500	5	.7651344	228,393	298,500	26	.2485628	74,195	19,700	50		333,551	561,944
Spring Dev.	111,000	5	.7651344	84,930					1,700	50		28,784	113,714
Catchments	690,000	5	.7651344	527,943					23,000	50		389,425	917,368
Reservoirs	21,000	5	.7651344	16,068					700	50		11,852	27,920
Wells	98,000	5	.7651344	74,983					1,400	50		23,704	98,687
Seedings - Artr	---	-							---	--			
Seedings - PJ	---	-							---	--			
Study Plots	6,000	5	.7651344	4,591					300	50		5,079	9,670
Trails	90,000	5	.7651344	68,862					8,200	50		138,839	207,701
Man-Months	379,500	5	.7651344	290,369					31,900	50		540,115	830,484
									Alternative No. 2 Total				3,435,571
Alternative No. 3													
Fence	502,500	5	.7651344	384,480					16,750	50	16.9315179	283,603	668,083
Pipeline	298,500	5	.7651344	228,393	298,500	26	.2485628	74,195	19,700	50		333,551	561,944
Spring Dev.	111,000	5	.7651344	84,930					1,700	50		28,784	113,714
Catchment.	690,000	5	.7651344	527,943					23,000	50		389,425	917,368
Reservoir	21,000	5	.7651344	16,068					700	50		11,852	27,920
Wells	98,000	5	.7651344	74,983					1,400	50		23,704	98,687
Seedings - Artr	482,400	5	.7651344	369,101					---	--			369,101
Seedings - PJ	264,000	5	.7651344	201,995	264,000	26	.2485628	65,621	---	--			267,616
Study Plots	6,000	5	.7651344	4,591					300	50		5,079	9,670
Trails	90,000	5	.7651344	68,862					8,200	50		138,839	207,701
Man-Months	501,600	5	.7651344	383,791					39,600	50		670,483	1,054,274
									Alternative No. 3 Total				4,296,008

Table 18

Comparison of Cost and Effectiveness

Subtraction of Incidental Development Benefits 1/

(1) Alternatives	(2) Present Value Cost	(3) Present Value Benefits	(4) Net Present Value Cost (2-3)
No. 1	$3,013,138	$ 121,494	$2,891,644
No. 2	3,435,571	230,870	3,204,701
No. 3	4,296,082	550,152	3,745,930

Effectiveness to Cost

(5) Alternatives	(6) Present Value Effectiveness (Equiv. Stable Acres)	(7) Net Present Value Cost	(8) Effectiveness to Cost Ratio E/C (6÷7)
No. 1	490,848	$2,891,644	0.17:1
No. 2	698,381	3,204,701	0.22:1
No. 3	976,238	3,745,930	0.26:1

1/ Incidental development benefits will be produced by this conservation project. These include added values of AUM's, Hunter days, and Visitor days. The E/C ratio must be adjusted to include these added benefits.

DEVELOPMENT - ECONOMIC ANALYSIS

Economic Analysis of Development Phase

Duckwater Watershed - Ely District, Nevada

Cost Analysis

Program of $662,985 over a 50-year period.

TABLE 19

Cost Evaluation - Initial Cost

Practice	Units	No.	Installation Cost	
Technical Assistance	M/M	7	$10,500	
Fences	Mi.	7	8,400	
Seed	Ac.	650	6,500	
Erosion Control Structure	No.	2	44,000	
Water Spreader	Cu. Yds.	200,000	200,000	
Flood & Sediment Control Structure	No.	1	200,000	
Subtotal				$469,400
Other Costs:				
Engineering Services	M/M	14	18,000	
Administration of Contracts	M/M	12	12,000	
Misc.	-	-	20,000	
Subtotal				50,000
Grand Total				$519,400

The initial cost of $519,400 for construction would be incurred during the first year; therefore, the present worth would be $519,400.

Operation and Maintenance Cost

Items	Annual Costs
Fences	$ 350.00
Water Spreaders	6,000.00
Flood and Sediment Control Structure	1,500.00
Total	$7,850.00

The present worth of $7,850 per period for 50 years at 5.125% interest = $7,850 X 17.9089 = $140,585.

Total Discounted Cost

Initial Cost	$519,400.00
O/M Cost	140,585.00
Total	$659,985.00

Benefits

Benefits shown are those attributable to the development phase of the Duckwater Watershed Plan.

1. AUM's Attributable to Development

Approximately 650 acres will be seeded in conjunction with the water spread development. About 200 acres will have a new level of production of 2 AUM's per acre or 400 AUM's. The balance of the area will have a level of production of 4 acres per AUM or about 90 AUM's.

The new total level of production would be 490 AUM's annually. The present level of production is nil.

The annual value of 490 AUM's at $2.50 each = 490 AUM's X $2.50 = $1,225.00.

Present value of $1,125 per year for 50 years at 5.125% interest = $1,125 X 17.9089 = $21,938.

2. Annual Flood Damage Avoided

Present value of damage prevented at a rate of $39,512 annually for 50 years = $39,512 X 17.9089 = $707,616.

3. General recreation visitor days, including hunting and fishing, were considered in this analysis. The proposed development would not result in a measurable benefit in visitor days.

Total Benefit = $21,938 + $707,616 = $729,554.

Development Summary

Costs - 50-year Life Expectancy

Initial Project Cost	$519,400
Operation and Maintenance	140,585
Total	$659,985

Benefits - 50-year Period

AUM's Increase	$ 21,938
Flood Damage Avoided	707,616
Total Benefits	$729,554

Benefit-Cost Ratio

$729,554/659,985 - 1:11:1

APPENDIX G

ESTIMATED WATERSHED PROJECT COSTS

FOR CONSERVATION AND DEVELOPMENT

TABLE 20

CONSERVATION Estimated Watershed Project Cost

Item	Unit	No.	Installation Costs	Average Annual Operation & Maintenance
Manpower Required	MM	456	$ 501,600	$ 39,600
Practices:				
Fences	Mi.	335	502,500	16,750
Wells	No.	7	98,000	1,400
Reservoirs Stockwater	No.	7	21,000	700
Spring Developments	No.	34	111,000	1,700
Seeding	Acre	77,900	746,400	---
Pipeline	Mi.	197	298,500	19,700
Water Catchment	No.	46	690,000	23,000
Study Plots	No.	6	6,000	300
Trails	Mi.	30	90,000	---
Road Maintenance	Mi.	100	---	8,200
	---	---	$3,059,000	$ 111,350
Other Costs:				
Equipment Chargeable to Project			15,600	
Total Watershed Project Cost			$3,074,600	$ 111,350
Program Services (30%)			922,380	33,405
Equipment Not Chargeable to Project			12,850	
TOTAL			$3,984,130	$ 144,755

TABLE 21

DEVELOPMENT Estimated Watershed Project Installation Cost

Practice	Units	No.	Installation Cost $	Operation & Maintenance $
Technical Assistance	M.M.	7	10,500	-
Fences	Mi.	7	8,400	350
Spray/Seed	Ac.	650	6,500	-
Pipeline	Mi.			
Water Spreaders	Cu. Yd.	200,000	200,000	6,000
Erosion Control Struc.	No.	2	44,000	-
Flood & Sediment Control Struc.	No.	1	200,000	1,500
TOTAL:			469,400	
Other Costs:				
Engineering Services	M.M.	14	18,000	
Administration of Contracts	M.M.	12	12,000	
Etc. Misc.			20,000	
TOTAL WATERSHED PROJECT COST:			519,400	7,850
Program Services 30%			155,820	2,355
TOTAL:			675,220	10,205

APPENDIX H

JOB DETAILS

FOR

ACTION PLAN

TABLE 22

WORKS OF IMPROVEMENT
MANAGEMENT AND LAND TREATMENT DATA
MANAGEMENT SYSTEM FACILITIES

Job Map Ref. No.	Practice	Unit	No. of Units	Unit Cost	Installation Cost	Annual Operation & Maint.	Effective Life Years
1	Fence	Mi.	20	1,500	30,000	1,000	50
2	Fence	Mi.	9	1,500	13,500	450	50
3	Fence	Mi.	9	1,500	13,500	450	50
4	Fence	Mi.	4	1,500	6,000	200	50
5	Fence 1/	Mi.	5	1,500	7,500	250	50
6	Spring Dev. & Pipeline	Mi.	3	1,500	6,000	350	25
7	Spring Development 1/	No.	1	1,500	1,500	50	50
*8	Spring Dev. & Pipeline	Mi.	4	1,500	10,500	450	25
9	Seeding PJ	Acre	9,000	15	135,000	---	25
*10	Spring Dev. & Pipeline 1/	Mi.	12	1,500	22,500	1,250	25
11	Spring Development	No.	1	1,500	1,500	50	50
12	Spring Development	No.	1	1,500	1,500	50	50
13	Spring Dev. & Pipeline 1/	Mi.	2	1,500	4,500	250	25
14	Fence	Mi.	13	1,500	19,500	650	50
15	Fence	Mi.	7	1,500	10,500	350	50
16	Fence	Mi.	1	1,500	1,500	50	50
17	Seeding PJ	Acre	1,000	15	15,000	---	25
18	Catchment	No.	1	15,000	15,000	500	50
19	Catchment	No.	1	15,000	15,000	500	50
20	Catchment	No.	1	15,000	15,000	500	50
21	Catchment	No.	1	15,000	15,000	500	50
22	Catchment	No.	1	15,000	15,000	500	50
23	Catchment	No.	1	15,000	15,000	500	50
24	Well	No.	1	14,000	14,000	200	50
25	Fence	Mi.	10	1,500	15,000	500	50
26	Spring Development	No.	1	1,500	1,500	50	50
27	Fence 1/	Mi.	7	1,500	10,500	350	50
[illegible]	Spring Dev. & Pipeline	Mi.	3	1,500	6,000	350	25

Job Map Ref. No.	Practice	Unit	No. of Units	Unit Cost	Installation Cost	Annual Operation & Maint.	Effective Life Years
*29	Spring Dev. & Pipeline 1/	Mi.	11	1,500	21,000	1,150	25
30	Well	No.	1	14,000	14,000	200	50
31	Fence	Mi.	11	1,500	16,500	550	50
32	Fence	Mi.	6	1,500	9,000	300	50
33	Catchment	No.	1	15,000	15,000	500	50
34	Catchment	No.	1	15,000	15,000	500	50
35	Fence	Mi.	8	1,500	12,000	400	50
*36	Spring Dev. & Pipeline 1/	Mi.	5	1,500	12,000	550	25
37	Catchment & Pipeline 2/	Mi.	2	1,500	18,000	700	25
38	Spring Development	No.	1	1,500	1,500	50	50
39	Spring Development	No.	1	1,500	1,500	50	50
40	Seeding PJ	Acres	1,200	15	18,000	---	25
41	Catchment	No.	1	15,000	15,000	500	50
42	Catchment & Pipeline 2/	Mi.	2	1,500	18,000	700	25
43	Fence	Mi.	2	1,500	3,000	100	50
*44	Spring Dev. & Pipeline 1/	Mi.	4	1,500	10,500	450	25
*45	Spring Dev. & Pipeline 1/	Mi.	4	1,500	10,500	450	25
46	Fence	Mi.	5	1,500	7,500	250	50
47	Pipeline	Mi.	7	1,500	10,500	700	25
48	Fence	Mi.	6	1,500	9,000	300	50
49	Catchment	No.	1	15,000	15,000	500	50
50	Catchment & Pipeline 2/	Mi.	2	1,500	18,000	700	25
51	Fence	Mi.	3	1,500	4,500	150	50
52	Fence	Mi.	5	1,500	7,500	250	50
53	Fence	Mi.	5	1,500	7,500	250	50
54	Seeding Artr	Acre	1,400	8	11,200	---	50
55	Catchment & Pipeline 2/	Mi.	2	1,500	18,000	700	25
56	Catchment	No.	1	15,000	15,000	500	50
*57	Spring Dev. & Pipeline 1/	Mi.	3	1,500	9,000	350	25
58	Fence	Mi.	5	1,500	7,500	250	50
59	Fence	Mi.	3	1,500	4,500	150	50
*60	Spring Dev. & Pipeline 1/	Mi.	3	1,500	9,000	350	25
61	Fence	Mi.	10	1,500	15,000	500	50
62	Spring Dev. & Pipeline 1/	Mi.	4	1,500	7,500	450	25
63	Fence	Mi.	7	1,500	10,500	350	50
64	Reservoir	No.	1	3,000	3,000	100	50

Job Map Ref. No.	Practice	Unit	No. of Units	Unit Cost	Installation Cost	Annual Operation & Maint.	Effective Life Years
65	Reservoir	No.	1	3,000	3,000	100	50
*66	Spring Dev. & Pipeline 1/	Mi.	3	1,500	9,000	350	25
*67	Spring Dev. Pipeline 1/	Mi.	3	1,500	9,000	350	25
*68	Spring Dev. & Pipeline 1/	Mi.	2	1,500	7,500	250	25
69	Catchment	No.	1	15,000	15,000	500	50
70	Reservoir	No.	1	3,000	3,000	100	50
71	Reservoir	No.	1	3,000	3,000	100	50
72	Reservoir	No.	1	3,000	3,000	100	50
73	Reservoir	No.	1	3,000	3,000	100	50
74	Reservoir	No.	1	3,000	3,000	100	50
75	Fence	Mi.	4	1,500	6,000	200	50
76	Catchment & Pipeline 2/	Mi.	4	1,500	21,000	900	25
77	Catchment & Pipeline 2/	Mi.	1	1,500	16,500	600	25
78	Fence	Mi.	5	1,500	7,500	250	50
79	Catchment & Pipeline 2/	Mi.	2	1,500	18,000	700	25
80	Seeding Artr	Acre	3,000	8	24,000	---	50
80	Seeding PJ	Acre	2,400	15	36,000	---	25
81	Fence	Mi.	7	1,500	10,500	350	50
*82	Spring Dev. & Pipeline 1/	Mi.	3	1,500	9,000	350	25
83	Fence	Mi.	4	1,500	6,000	200	50
*84	Pipeline	Mi.	2	1,500	6,000	200	25
*85	Spring Dev. & Pipeline 1/	Mi.	3	1,500	9,000	350	25
86	Fence	Mi.	9	1,500	13,500	450	50
87	Fence	Mi.	11	1,500	16,500	550	50
88	Catchment	No.	1	15,000	15,000	500	50
89	Catchment	No.	1	15,000	15,000	500	50
90	Fence	Mi.	1	1,500	1,500	50	50
91	Well	No.	1	14,000	14,000	200	50
92	Catchment & Pipeline 2/	Mi.	2	1,500	18,000	700	25
93	Catchment	No.	1	15,000	15,000	500	50
94	Catchment	No.	1	15,000	15,000	500	50
95	Seeding Artr	Acres	1,500	8	12,000	---	50
95	Seeding PJ	Acres	4,000	15	60,000	---	25
96	Catchment & Pipeline 2/	Mi.	1	1,500	16,500	600	25
97	Catchment & Pipeline 2/	Mi.	1	1,500	16,500	600	25

Job Map Ref. No.	Practice	Unit	No. of Units	Unit Cost	Installation Cost	Annual Operation & Maint.	Effective Life Years
98	Fence	Mi.	7	1,500	10,500	350	50
99	Fence	Mi.	5	1,500	7,500	250	50
100	Catchment	No.	1	15,000	15,000	500	50
101	Catchment	No.	1	15,000	15,000	500	50
102	Catchment	No.	1	15,000	15,000	500	50
103	Seeding Artr	Acres	2,400	8	19,200	---	50
104	Catchment	No.	1	15,000	15,000	500	50
105	Catchment & Pipeline 2/	Mi.	4	1,500	21,000	900	50
106	Catchment & Pipeline 2/	Mi.	2	1,500	18,000	700	50
107	Catchment & Pipeline 2/	Mi.	2	1,500	18,000	700	50
108	Catchment	No.	1	15,000	15,000	500	50
109	Well	No.	1	14,000	14,000	200	50
110	Fence	Mi.	5	1,500	7,500	250	50
111	Catchment	No.	1	15,000	15,000	500	50
112	Fence	Mi.	9	1,500	13,500	450	50
113	Catchment	No.	1	15,000	15,000	500	50
*114	Spring Dev. & Pipeline 1/	Mi.	5	1,500	12,000	550	25
115	Spring Dev. & Pipeline 1/	Mi.	2	1,500	4,500	250	25
116	Catchment	No.	1	15,000	15,000	500	50
117	Fence	Mi.	2	1,500	3,000	100	50
118	Catchment	No.	1	15,000	15,000	500	50
119	Spring Dev. &Pipeline 1/	Mi.	2	1,500	4,500	250	25
*120	Spring Dev. & Pipeline 1/	Mi.	18	1,500	31,500	1,850	25
121	Fence	Mi.	12	1,500	18,000	600	50
*122	Spring Dev. & Pipeline 1/	Mi.	8	1,500	16,500	850	25
123	Well	No.	1	14,000	14,000	200	50
124	Fence	Mi.	10	1,500	15,000	500	50
125	Fence	Mi.	10	1,500	15,000	500	50
*126	Spring Dev. & Pipeline 1/	Mi.	9	1,500	13,000	950	25
127	Spring Dev. & Pipeline 1/	Mi.	2	1,500	4,500	250	25
128	Spring Dev.	No.	1	1,500	1,500	50	50
129	Catchment	No.	1	15,000	15,000	500	50
13[illegible]	Well	No.	1	14,000	14,000	200	50

Job Map Ref. No.	Practice	Unit	No. of Units	Unit Cost	Installation Cost	Annual Operation & Maint.	Effective Life Years
131	Seeding Artr	Acre	26,000	8	208,000	----	50
132	Well	No.	1	14,000	14,000	200	50
133	Fence	Mi.	24	1,500	36,000	1,200	50
134	Pipeline	Mi.	1	1,500	1,500	100	25
135	Catchment & Pipeline 2/	Mi.	1	1,500	16,500	600	25
136	Fence	Mi.	6	1,500	9,000	300	50
137	Catchment & Pipeline 2/	Mi.	2	1,500	18,000	700	25
138	Fence	Mi.	10	1,500	15,000	500	50
139	Catchment & Pipeline 2/	Mi.	3	1,500	19,500	800	25
140	Fence	Mi.	9	1,500	13,500	450	50
*141	Spring Dev. & Pipeline 1/	Mi.	6	1,500	13,500	650	25
*142	Spring Dev. & Pipeline 1/	Mi.	16	1,500	28,500	1,650	25
143	Seeding Artr	Acre	26,000	8	208,000	----	50
144	Fence	Mi.	6	1,500	9,000	300	50
145	Fence	Mi.	9	1,500	13,500	450	50
146	Fence	Mi.	9	1,500	13,500	450	50
*147	Spring Dev. & Pipeline 1/	Mi.	7	1,500	15,000	750	25
148	Catchment & Pipeline 2/	Mi.	5	1,500	22,500	1,000	25
149	Catchment	No.	1	15,000	15,000	500	50
150	Catchment	No.	1	15,000	15,000	500	50
151	Catchment & Pipeline 2/	Mi.	2	1,500	18,000	700	25
---	Study Plots 10/	No.	6	1,000	6,000	300	50
---	Trails 10/	Mi.	30	3,000	90,000	----	---
	TOTAL	---	---	---	$2,563,400	$63,550	---

*Add $3000 for additional water storage

1/ Spring Dev. & Pipeline - $1,500 for Spr. Dev. and $1,500/mi. for pipeline

2/ $15,000 catchment and $1,500 for mi. pipeline.

3/ 17,250 acres

4/ 8,750 acres each

5/ 3,000 acres

6/ Need 2 mi. fence

7/ [illegible]d 2 mi.

8/ [illegible]mi. needed

[illegible] mi. needed

TABLE 23

DEVELOPMENT Structural Data - Description of Structural Measures

WATERSPREADING DIKES

Drainage Area Uncontrolled Sq. Miles	Drainage Area Controlled Sq. Miles	Earth 1000 Cu. Yd.	Storage water acre/ft.	Storage sediment acre/ft.	Spillway Princ. cfs.	Spillway Emerg. cfs.	Design Freq. yrs.	Type
70.25	101.95	200	562	153	-	-	100 (Rain)	Earth

DROP STRUCTURES

29.75	101.95	15	100	20	75	1000+	100 (Rain)	Earth
0	172.00	15	100	20	75	1000	100 (Rain)	Earth

TABLE 24

DEVELOPMENT - FLOODWATER RETARDING STRUCTURES

ITEM	UNIT	1	2	3	4	5	6	7	8	9
Drainage Area	Sq. Mi.	17.0	21.5	10.5	7.91	5.95	70.81	100	172.49	19.6
Storage Capacity										
Sediment	Ac. Ft.	85	107	52	39	29	265	375	646	98
Floodwater	Ac. Ft.	226	286	140	105	79	1,057	1,493	2,575	261
Total	Ac. Ft.	311	393	192	144	108	1,322	1,868	3,222	359
Volume of Fill	Cu. Yds.	67,000	67,612	12,500	6,653	10,000	78,000	110,000	360,000	39,300
Elevation Top of Dam	Ft.	6,192	6,070	6,260	6,185	6,070	5,979	5,854	5,605	6,188
Maximum Height of Dam	Ft.	38.0	30	27.0	18	25	37	44	38	38
Emergency Spillway	Ft.	6,187	6,065	6,255	6,180	6,065	5,974	5,848	5,600	6,183
Crest Elevation	Ft.							500		
Bottom Width	Ft.							Earth		
Type		Earth	Earth	Earth	Earth	Earth	Earth	1	Earth	Earth
Percent Chance of Use		1	1	1	1	1	1		1	1
Ave. Curve No. - Cond. II										
Emergency Spillway Hydrograph 2/										
Storm Rainfall (6-hrs.)	In.							3.48		
Storm Runoff	In.							1.102		
Velocity of Flow (Vc.) 1/	Ft./Sec.							10.4		
Discharge Rate 1/	c.f.s.							15,738		
Max. w.s. elev. 1/	Ft.							5,851		
Principal Spillway										
Capacity	c.f.s.							275		
Capacity Equivalents										
Sediment Volume	In.							.0703		
Detention Volume	In.									

1/ Maximum during passage of hydrograph.

2/ One-half maximum probable precipitation for this area, 6 hr., detention area empty.